# Seasonal Erodibility Measurements at Peterstone Wentlooge, Cardiff, UK, April 1997 to January 1998

## Data Report

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# Summary

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Staff from HR Wallingford Ltd and University of Cardiff took part in a seasonal erodibility survey at Peterstone Wentlooge mudflat site situated on the north bank of the Severn Estuary, UK. The site was visited systematically every month during full moon spring tides and erodibility measurements and sediment sampling were carried out over the low water period. The objective of the survey was to collect a data set of erodibility and surface sediment properties so that seasonality of sediment characteristics could be investigated, and intercomparisons between erodibility and sediment properties could be made.

The survey months were April to September 1997, with an additional day's survey during January 1998 to represent winter conditions. 3 different stations were monitored during the survey, on a shore-normal transect extending seawards from Mean High Water Neaps level. The locations were named A, C and C/D, located 200m, 400m and 450m offshore respectively. These locations corresponded to comparable stations set up for a long-term bed-elevation survey set up by O'Brien in 1996.

During each day's deployment SedErode (HR Wallingford's instrument for measuring the critical erosion shear stress of muddy sediments in-situ) was deployed 3 times at each station to measure erodibility. Surface sediment scrape samples were also taken by University of Cardiff and analysed for bulk density, mass loss on ignition, grain size analysis, and colloidal carbohydrate content. Sediment temperature and hand shear vane measurements were also taken together with detailed observations and photographs of each site.

During the survey period there was substantial erosion at the site, in excess of 50mm at site C. The surface soft mud deposit had been largely eroded by the time of the January 1998 survey, and the underlying Flandrian clay was exposed, fully at site B/C (350m offshore), and in patches at other sites. There were a large number of ragworms (*Neries diversicolor*) and small snails (*Hydrobia ulvae*) observed at the site living within the surface soft mud layer during the summer months. During January 1998, there was little or no evidence of these species within the Flandrian clay, and they appeared to have died back and disappeared along with the surface mud sheet. The surface mud density and loss on ignition values were significantly different for the surface mud sheet and underlying Flandrian clay.

A total of 54 measurements of surface erodibility and surface sediment properties were taken. The critical erosion shear stress values ranged from 0.10$Nm^{-2}$ to 0.46$Nm^{-2}$ over the 3 stations, and this covered a wide range of climatic conditions and surface mud characteristics. The surface sediment bulk density ranged from 1174$kgm^{-3}$ to 1406$kgm^{-3}$ for the surface mud sheet and 1448$kgm^{-3}$ to 1602$kgm^{-3}$ for the Flandrian clay.

The mud was predominately comprised of clay and silt, with most surface material containing less than 5% sand by weight. The median grain size values were also low ranging between 1.6 and 6.1 microns. The silt fraction was the most dominant with values between 41% and 79%, and the clay fraction ranged between 21% to 56%. There were no significant variations in the grain size distribution of the surface mud samples during the seasonal survey.

The loss on ignition (LOI) values were high for the summer mud sheet between 7.39% and 14.40% by weight, and appeared to weakly reflect the sediment temperature on the day and the biological activity. The colloidal carbohydrate values followed the LOI trend and were between 0.49$mgg^{-1}$ and 6.48$mgg^{-1}$. The January 1998 values of LOI and colloidal carbohydrate were much lower in the colder conditions and reflected the low biological activity observed.

Some preliminary correlations in the data set are presented. The processed data can now be analysed further and compared or correlated with other relevant data to assess the processes occurring at the Peterstone Wentlooge site, Cardiff in the Severn Estuary, UK.

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# 1. INTRODUCTION

SedErode (ISIS Mark II, Mitchener 1996) was deployed on 7 different days over a 10 month period at the Peterstone Wentlooge mudflat site in the Severn Estuary, UK to monitor sediment erodibility on a seasonal timescale. During the survey HR Wallingford Ltd took erodibility measurements at 3 stations on the mudflat in collaboration with the University of Cardiff, Department of Earth Sciences, who undertook surface sediment sampling simultaneously at the same sites. The sediment samples were analysed by the University of Cardiff to obtain physical and biological sediment properties.

This report is primarily a data report which describes the collection, methods, analysis and results of the seasonal survey. The report also describes the key findings of the seasonality of the sediment properties and erodibility at this site, and some sediment property intercomparisons.

# 2. OBJECTIVES

The purpose of the seasonal survey was to provide a comprehensive data set of sediment erodibility and associated physical and biological properties. The data set was collected systematically under the same tidal conditions (full moon spring tide) in order to try and minimise the tidal influence and highlight any underlying seasonal trends. The data was collected to INTRMUD protocols (INTRMUD 1997) and provides a dataset within the INTRMUD project to investigate sediment property relationships existing on intertidal mudflats. It is anticipated that the INTRMUD participants will use the data collected to parameterise mudflat processes and further our understanding of in-situ erodibility.

# 3. SEDERODE INSTRUMENT

## 3.1 Description

SedErode has been developed to measure the erosion shear stress of cohesive sediments in-situ. The need for such an instrument was identified because of the difficulty of simulating natural conditions in the laboratory, and the effects of collection, transport and storage on field sediment samples. SedErode is the successor to ISIS (Instrument for shear Stress In-Situ) and is a portable, fully contained instrument for use on intertidal mudflats and other cohesive sediments (Mitchener et al, 1996). Williamson and Ockenden (1996) give a full technical description of ISIS.

The basic principle of SedErode is that known shear stresses can be applied to a mud surface and the bed response (turbidity) can be monitored. From these measurements the erodibility can be assessed.

The instrument consists of 2 units: a bell head unit and a pump and control unit. The instrument is fully portable, with internal rechargeable batteries and has been designed for use on intertidal mudflats. Figure 3 shows the major components of the SedErode system.

The shear stresses applied with SedErode are generated by water flow through the circular, bell-shaped head which fits inside a cylindrical perspex column with an annular clearance of 3mm. The bell head is positioned 5.8mm above the sediment surface and water is drawn radially across the test surface, up through the centre of the bell, and recirculated to be replaced under the bell head via a diffuser.

A mixing chamber within the recirculating system allows the eroded sediment to be thoroughly mixed into the system volume and a nephelometer measures the turbidity of the recirculating water. The volume of the SedErode recirculating system is approximately 1 litre. During each SedErode test a solid state logger records both the reservoir turbidity and the recirculating flow discharge. These are also noted at regular intervals by the operator during a measurement run.

During an erosion test the flow discharge is progressively increased in small steps until a turbidity jump is observed, which corresponds to material being removed from the bed surface and mixing into the recirculating volume. At this point the critical shear stress for the initiation of erosion is exceeded. Further increases in the applied shear stress result in further sediment being eroded from the bed surface and confirm that surface erosion has been initiated.

## 3.2 Deployment method

A 9cm diameter flat mud surface was selected for each measurement and a photograph of the site was taken prior to positioning SedErode. The SedErode head unit was then planted into the mud bed so that the locating tube was pushed into the bed and the unit rested on the supporting flange. (Plate 3 shows SedErode deployment at station CD1 in April 1997). This isolated a 9cm diameter area of mud surface. With the bleed valves open to expel air, the SedErode system was carefully filled with local, clear seawater (collected at high water and left to settle and deaerate overnight before each deployment). The bleed valves were shut and the power cable and logging connections were established. The nephelometer turbidity sensor was zeroed, and logging of discharge and turbidity commenced. The logging interval was 2 seconds. The lowest discharge setting (i.e. the lowest applied shear stress) was applied for at least 2 minutes to allow the water within the recirculating system to become fully mixed. This allowed a baseline turbidity to be established prior to increasing the applied shear stresses and monitoring the erosion response. The discharge was increased in controlled steps to apply increasing shear stress steps to the mud surface.

The measurement run took about 10-20 minutes to complete at each site, with additional time for sediment observations and surface sampling.

## 3.3 Analysis

Each SedErode run resulted in a raw time series of time, voltage output from the nephelometer (turbidity sensor) and pump operating voltage at 2-second intervals. The raw data was downloaded onto computer and 3.5" disks at the end of each survey day. The raw data was then processed via calibration functions to produce time series of applied shear stress and Cardiff mud concentration within the SedErode recirculating system.

The pump voltage was recorded on channel 7 of the data logger. This data was processed into discharge via the SedErode pump calibration (pump A) using the following equation:

$$Q = 0.2352.\ln(PV) - 0.1877 \quad (1)$$

where:

Q = discharge (l/s)
PV = logged pump voltage
The fit parameter $r^2$ was above 0.99 for this regression.

The applied shear stress was then calculated using the mud temperature and eroding water salinity which determined the coefficient A in the relationship (Mitchener et al 1996):

$$\tau_{ap} = A.Q \quad (2)$$

where:
A = dimensional coefficient dependent on salinity and temperature
$\tau_{ap}$ = applied bed shear stress ($Nm^{-2}$)

The nephelometer output was recorded on channel 8 during the SedErode deployments. Scale 3 was used throughout the deployments in which the millivolt output from the nephelometer was directly equivalent

to the measured NTU (Nephelometer Turbidity Units). The nephelometer was post-calibrated at HR Wallingford Ltd against calibration suspensions made up with surface mud collected from the Peterstone Wentlooge mudflat. The suspensions were in the range 0 to 2000mg/l. Three NTU readings were recorded for each concentration. The recorded millivolts were processed via a 2-stage calibration: first from millivolts to NTU, and then from NTU to Cardiff mud concentration via the following equation:

Cardiff mud concentration (mg/l) = 1.4904 (NTU) (3)

The fit parameter $r^2$ was 0.992 for this regression.

Observations and photographic records were added to the shear stress versus concentration plots (EXCEL worksheets) for each deployment together with the calibrated time series of applied shear stress and suspended mud concentration.

The incipient point of erosion corresponded to an increase in the concentration profile above the baseline which indicated that material had been removed from the bed and mixed into the recirculating system. On the time series plots these shear stress steps are indicated as $\tau_A$ and $\tau_B$ which are the lower and upper shear stress steps respectively. For runs where erosion started at the lowest applied shear stress $\tau_B$, then $\tau_{cr}$ was calculated as the average between 0 and $\tau_B$. Further higher applied shear stress steps then resulted in higher concentrations and confirmed that surface erosion had been initiated. The increase in concentration was sometimes reflected in an associated spike in the erosion rate, but was dependent on the nature of erosion. For small, slow increases in concentration associated with discrete small particle removal the erosion rate spikes were small, and almost insignificant, compared with the sharp concentration rises and erosion rates associated with bulk surface rupture.

The erosion rate was also calculated from the concentration time series based on the area under the SedErode head of diameter 9cm and the logging time interval of 2 seconds, and the SedErode recirculating volume of 1 litre.

The SedErode data was output as time series plots of applied shear stress against concentration and erosion rate, together with surface sediment observations and properties (Please see Appendix 1).

# 4. SITE DESCRIPTION

## 4.1 General morphology

Figure 1 shows the general Peterstone Wentlooge location map. The survey site was located mid-way between Cardiff (to the West) and the River Usk at Newport (to the East) on the northern side of the Severn Estuary. The estuary has a large tidal range, and is macrotidal, with a major fetch to the West, facing the Irish Sea. Typical tidal ranges during the spring tide conditions under which the seasonal survey was conducted were 11.3 to 14.3m. Plate 1 shows the Peterstone Wentlooge site looking onshore from about 500m offshore. The mudflat site faces south-east, with a width of about 1km, and has a slope of about 1:93.

Figure 2 shows a cross-shore profile of the seasonal survey transect. The site is backed by a bund for sea protection, and a narrow saltmarsh, which was covered in *Spartina* grass during the summer months which extends 100m offshore. The saltmarsh has a ridge-runnel structure, aligned approximately onshore-offshore, in an irregular pattern, with consolidated ridges. The runnels in the saltmarsh are filled with broken shell deposits which may be associated with storm events during which material is thrown onto the upper mudflat. There is a transition zone between 100 to 200m offshore, where the topography changes from a corrugated saltmarsh with vegetation to the soft, flatter mudflat proper. Plate 2 shows the transition zone, saltmarsh and bund, and the runnel structures extend into the saltmarsh. SedErode was deployed on the mudflat proper and Plate 3 shows SedErode in position at station C/D1 on 22/4/97. The

lower photograph shows the general site looking onshore from about 300m offshore. It shows the meandering ridge-runnel system flattening out onshore towards the saltmarsh.

## 4.2 Small scale features

Plate 4 shows a close up photograph of runnel features on 16 and 18 September 1997. The upper plate, taken on 16 September, shows shell fragments in the deepest part of the channel, and the black speckled appearance of the runnel banks is due to the migration of small snails (*Hydrobia ulvae*) into the damp areas of the mudflat. In the foreground the mud surface is covered by small holes, which are the burrows of the ragworm (*Nereis diversicolor*), which favoured the drier, raised areas of the mudflat. In the top right background of the upper photograph there are bird prints which have disturbed the surface of the mud. The larger pits in the photograph may be holes made by bird beaks during feeding in search of worms under the surface. The lower plate shows the same drainage runnel on 18 September 1997 (2 days after the upper photograph). This photograph shows a recently deposited mud sheet, which forms a blanket over the site of the order 2 – 3cm thick and overlies the previous bed surface. This order of deposition over a single tide has been found previously at this site (O'Brien and Whitehouse, in prep.). It is interesting to note that the biology has quickly adapted to the new surface, and worm holes, bird footprints and snails are reestablished. The mud is typically underconsolidated, and the edge of the runnel has undergone partial erosion by slumping of the bank into the channel. Eroded material is typically observed as small, spherical balls which were transported downstream in the drainage channels during the run-off period.

The whole site has an underlying layer of consolidated blue-grey Flandrian clay, and there are also sporadic exposed peat outcrops further offshore. The Flandrian clay was usually covered by a soft brown surface mud layer of varying thickness between 0cm and 30cm. Station A, closest to the shore had a persistent depth of 8cm to 10cm of surface deposit over the summer months which dropped sharply in November 1997 to 1cm in January 1998. Station C was slightly thicker with surface layer thickness between 9cm and 14cm in the summer months and sharply dropped during the winter to 2cm. Station C/D had a thicker surface deposit than the upper mudflat, which gradually receded during the summer months. The sheet was at its thickest at this site in May 1997, at 28cm and dropped slowly during the whole survey period to 1 1cm. In general, at the Peterstone Wentlooge site, the thicker the sediment layer, the lower the topographic position (O'Brien and Whitehouse, in prep.)

During the early part of the survey, in April and May 1997, the mudflat sites were characterised by a soft mud sheet over the majority of the transect. Plate 5 shows the exposed blue-grey Flandrian clay base during September 1997, after substantial erosion, with outcrops of soft mud on the ridges. The surface of the eroded mud is pitted and irregular, and still contains many worm burrows. The lower plate shows the edge of an exposed eroded gully, where distinct layering is visible. The layers probably represent tidal depositional events which are quite uniform between 5 and 10mm thick (O'Brien and Whitehouse, in prep.). There are softer mud deposits still visible in patches at the edge of the runnel bed and sporadically in more of protected areas of the mudflat surface.

Plate 6 shows distinct consolidated layers within the Flandrian clay at site C/D in September 1997. It also shows the very rough small scale topography of the eroding bed surface, which is in clear contrast with the smooth freshly-deposited surface shown on previous plates. The lower photograph shows the eroded surface at this site and a thin veneer of soft mud on top of the base clay. The edge of the eroding patch is ragged, and the eroded surface is again very irregular and pitted.

Plate 7 shows additional surface features observed at station A during January 1998. The upper photograph shows longitudinal scour marks in the surface soft mud aligned in the onshore-offshore direction. There was a large flock of birds at the site before the January 1998 survey, and the lower photograph shows the highly disturbed surface soft mud which is roughened by the action of bird footprints.

## 4.3 Survey station characteristics

Station A, 200m offshore, was typically flatter and smoother than the offshore stations, with less pronounced ridge-runnel features and drainage gullies extending offshore from the saltmarsh edge at approximately 15m intervals in the longshore direction. Plate 8 shows the onshore (upper) and offshore (lower) views at this site in September 1997. Plate 9 shows station A in April and September 1997 respectively, and shows flat ridge-runnel features in April which are smoothed out by a soft surface deposit in September which largely blankets out the topographical features leaving only the major drainage runnels as clear features.

An irregular shore-normal ridge runnel system developed further offshore, and station C, 400m offshore, represented the developing topography, with station C/D having a fully developed ridge runnel topography. Plate 10 shows site C with smoother topography after a depositional tide (upper photograph in June 1997) and more pronounced pitted ridge runnel features after an eroding tide (16 September 1997). Plate 11 shows site C after substantial deposition on 18 September, 2 days later, when the pitted features have been obscured by a blanket deposit.

An established ridge runnel system was typically found 300m to 500m offshore. The typical developed ridge widths were 40 to 70cm, with a height of 10cm. The drainage channels cut though the ridge-runnel system at 10 to 20m intervals, and were aligned more directly onshore-offshore. Site C/D was located in this area, 450m offshore, and was characterised by a persistent irregular ridge-runnel system. Plate 12 shows site C/D in May and June 1997, and shows the established ridges at this site. The May photograph (upper) shows the situation when the runnels have been partly filled in by a surface deposit.

# 5. SAMPLING STRATEGY

The seasonal survey was carried out systematically so that the same deployment protocol was applied during each survey visit. The survey stations were visited sequentially offshore, with deployments first at station A, then C and finally station C/D. This meant that similar exposure times were experienced at each site before deployment commenced. During the April survey, there were some difficulties in deploying SedErode at station C because of drainage though wormholes during SedErode filling, and for this survey, site C/D was sampled before going back to site C later in the day. The filling and bleeding procedure was also improved after the April survey. SedErode measurements were always taken on ridge features during the survey.

Table 1 shows a summary of the seasonal sampling schedule, and the number of successful deployments at each station. There were some filling difficulties due to drainage through wormholes, especially during the summer months at stations C and C/D, when the volume of burrows within the sediment matrix was estimated at over 30% by volume. A total of 54 measurements of critical erosion shear stress measurements were made and analysed and 70 surface sample scrapes were analysed for physical and biological properties.

Each SedErode measurement was supported by detailed surface sediment observations and photographs, 5 shear vane measurements, eroding water salinity determination and surface sediment temperature. A Pilcon hand shear vane was used with a vane diameter of 33mm and 5cm length inserted to an operational depth of 3-8cm.

Surface sediment scrapes were taken by the University of Cardiff by lightly skimming a spatula edge over the sediment surface. The samples were analysed for physical and biological sediment properties. Three surface scrape samples were taken at each SedErode deployment site, at the same time as SedErode measurements were being taken. One sample from each site was kept on ice until it could be frozen prior to carbohydrate analysis. The second sample was analysed for physical properties (bulk density, loss on ignition and grain size distribution), and a third sample was stored as an archive sample. Appendix 1 describes the methods as used by the University of Cardiff to analyse the sediment samples. It must be

noted that although physical sediment properties were analysed for each SedErode site, the carbohydrate analyses were only carried out on the mid-sample from each station (typically site number '2' – for example from deployment 5C/D2).

Table 2 shows the climatic conditions on the survey dates. The weather conditions were very variable during the survey, and did not typically represent the expected conditions for the months represented. For example, the conditions during April and September were very hot and sunny, whereas May and June were cloudy and changeable with some showers.

During April to September 1997, stations A, C and C/D were visited and the surface soft mud sheet was investigated. The January 1998 survey was undertaken to investigate the properties of the Flandrian clay, and as many other full stations in triplicate as possible. There was limited daylight during this survey day over the low water period, and thus only site A and site B/C (where the Flandrian clay was exposed) were visited .

## 6. RESULTS

Appendix 2 shows the detailed SedErode plots for each site, including photographs and erosion response (concentration) time series for each deployment. Tables 3 to 9 show the detailed raw data collected for each of the 7 survey dates. The data was then processed to investigate the mean values and variabilities of the triplicate site data of physical sediment properties and erodibility data. Tables 10 and 11 show the arithmetic means and standard deviations of the data used for time series analysis and intercomparisons. The critical shear stress average values are the arithmetric means of the available data, with sample populations indicated in Table 1. The data was then investigated for seasonal trends and relationships between sediment properties and erodibility.

Table 12 summarises the form of the relationships and the fit values, $R^2$, to show the relative strength of the derived relationships. The strongest relationships exist between colloidal carbohydrate and temperature, and critical erosion shear stress and water content, with $R^2$ values over 0.4. The relationships are discussed for each sediment property in the following sections.

### 6.1 Temporal patterns

Figure 4 shows the mean time series data for the critical erosion shear stress and surface sample water content during the months April to September 1997 (all data). Figure 5 shows the time series data for loss on ignition and bulk density during the same period.

In general the average critical erosion shear stress of the mudflat surface decreased over the summer months. This is reflected in a downward trend in the average values by about $0.2Nm^{-2}$ from April to September. The highest value in $\tau_{cr}$ was $0.45Nm^{-2}$ found at site C/D in May and the lowest values ($0.10Nm^{-2}$ to $0.13Nm^{-2}$) were found at site A, which corresponded to erosion occurring at the lowest SedErode applied shear stress. The water content at site C/D was also much lower than the other 2 sites, and instead there is a gradual decrease in water content with time as seen at A and C, there is only a slight increase at site C/D in August and September.

Between April and September 1997 sites A and C on the upper mudflat show a decrease in erosion resistance which appears to be connected to the overall increase in water content, or softening of the surface deposit at these sites.

Site C/D however, on the established ridge-runnel region lower down the mudflat, shows a different erosion character to sites A and C. The average erodibility data shows more variability and there is a less distinct seasonal trend. But interestingly, standard deviations of the erodibility triplicate measurements

decrease from site A to C/D (down the mudflat). So although the erodibility changes more at site C/D, the repeatability of the measurements and spatial homogeneity increases at this site. This may be due to the persistence of the ridge runnel features and microtopography, and the erosion variability throughout the survey period due to the erosion occurring at the site exposing different sediment surfaces.

Figure 6 shows the time series data for colloidal carbohydrate content and surface sediment temperature. Sites A and C show sinusoidal shaped curves for the time series of LOI, carbohydrate and temperature between April and September, with a reduction to June, then an increase up to August and a further reduction after September. The increase in these properties may reflect a bloom in biological activity over the summer months due to increased primary productivity due to more sunlight and higher temperatures. Site C/D does not show this relationship for carbohydrate, and instead gradually increases from May to September.

## 6.2 Erodibility

The strongest relationship between the critical erosion shear stress exists for surface physical sediment properties (Table 12). Critical erosion shear stress decreases linearly with water content of the surface, with an $R^2$ value of 0.42, and increases with bulk density with an $R^2$ value of 0.32. There appears to be a weak relationship between critical shear stress and decreasing temperature which has a fit of 0.24. The relationships between critical shear stress and biological parameters and grain size are less pronounced with $R^2$ values for these relationships below 0.20. Figures 7 and 8 show the 4 strongest relationships between critical erosion shear stress and water content, bulk density, temperature and LOI respectively.

There is considerable scatter in the erodibility data for these relationships which reflect the spatial inhomogeneity of the sediment and the fact that erodibility is dependent on a complex combination of sediment properties and erosion/deposition history. Localised bioturbation and organism spatial migration will also result in small scale spatial and temporal variations in erodibility. There is no relationship between vane shear strength and critical erosion shear stress (Table 12) which further indicates the layered structure of the sediment and inhomogeneity of surface characteristics as compared to the underlying sediment structure.

## 6.3 Grain size

The grain size was fairly uniform at the site, with $d_{50}$ between 1.6 and 6.1 microns over the survey period. The highest values of $d_{50}$ were found at site A, which reflects the coarse material persistent at this site. The lowest value was at site C/D2 in May. The predominant sediment at the survey site was silt, between 2 and 63 microns. There was typically less than 5% sand in the surface deposit, with a maximum value of 5.8% at site CD in April. January 1998 showed no sand within the surface sediment, and the silt content of the surface mud sheet and Flandrian clay was 20 – 30% clay and 70 – 80% silt under winter conditions. The clay content ranged from 21% at its lowest at site A in April and January, and reached 56.2% at site A in July. The range of grain size parameters was low and reflected the persistence of a dominant surface sediment, and there were no significant changes in the material composition. Given the homogeneity of the sediment composition, it was not sensible to derive relationships between other sediment variables, as the ranges covered were so small. There were also no spatial differences in sediment composition across the mudflat between April and September 1997, when the surface mud layer was present.

The situation in January 1998 was different, however, as the surface mud layer was not present at site B/C and the underlying Flandrian clay was exposed. Figure 9 shows the grain size analysis for station A and station B/C during January 1998. Site A represented the persistent brown surface layer, and samples from B/C were taken from the base Flandrian clay layer. There is a distinct bimodal distribution for site B/C, which indicates that the sediment was derived from 2 different sources. On observation of the grain size curve for the soft mudsheet at Site A, it was clear that the surface mud at B/C was comprised of eroded Flandrian clay and soft mud layer material.

## 6.4 Temperature and biological parameters

The temperature ranged from 8°C in January 1998 up to a peak at 30°C in July 1997. Typical values were around 20°C during the summer months, and the values reflected the daily conditions and were highest during calm conditions. The LOI values ranged from 7.39% in May to 14.40% in August 1997, both at site A. Typical values were between 8 and 12% for the overall site, and peak values were found during August and September reflecting a summer biological bloom. The colloidal carbohydrate values also reached maximum values during the summer months. The minimum surface carbohydrate values were encountered in cooler months of April and January at around 0.50mgg$^{-1}$, and rose to 6.48mgg$^{-1}$ at site C in July. The strongest relationship for the Cardiff seasonal survey was between colloidal carbohydrate and sediment temperature with an $R^2$ valve of 0.64. There was only a weak relationship however between LOI and colloidal carbohydrate as indicated by an $R^2$ value of only 0.22 (Table 12). Figure 10 shows the relationships between colloidal carbohydrate, loss on ignition and sediment temperature. Both parameters increase with temperature, with high $R^2$ values (Table 12). This is probably attributable to higher productivity on the mudflat surface by microphytobenthos, namely diatoms, under sunny, warm conditions which produce colloidal carbohydrate and will increase the organic carbon content of the surface sediment.

# 7. DISCUSSION

In general there are no strong seasonal trends existing at the site in as much as the topographical development of the mudflat during the summer months (O'Brien and Cramp, in prep.) is not reflected in the erodibilty of the mudflat surface. There is a good relationship between the sediment compaction and critical erosion shear stress, as represented by bulk density and water content. But surprisingly, given the large numbers of macrofauna on the mudflat over the summer months, the erodibility was not controlled by the biological indicators (carbohydrate and loss on ignition). The concentration of colloidal carbohydrate, indicating the presence of diatoms, had a strong correlation with the sediment temperature (a seasonal indicator) but did not correlate with erodibility indicating surface cohesion as would be expected (Paterson et al. 1989). It is concluded that at this site during spring tide conditions bio-stabilization and bioturbation are secondary processes and that the inherent sediment matrix (the water content) is the major controlling factor in governing the surface erodibilty.

The reduction in critical erosion shear stress from April to September 1997 may reflect the calm conditions generally experienced over the summer period allowing the soft fluid mud sheet deposited at slack tide to persist on the surface. The stability measurements were made under spring tide conditions when deposition is likely to be at its greatest in the absence of wind waves and with increased sediment load. (Whitehouse and Mitchener, in press; O'Brien and Whitehouse, in prep.). The erosion threshold at site C/D was generally higher than at Stations A and C. This is probably due to spatial differences in deposition across the flat and the persistent ridges found at site C/D. Station C/D was visited last on each survey day so any sub-aerial processes (drainage, drying) would have had longer to cause increases in the surface erodibilty.

The sediment composition at Peterstone-Wentlooge is spatially consistent unlike other inter-tidal flats where the sand fraction increases with off-shore distance (Amos, 1995). Changes in erosion shear stress are often attributable to sediment composition (Mitchener et al 1996) but not in this case. At this site the surface erodibility of the sediment is the result of a complex dynamic exchange of sediment between the mudflat and the estuary.

There was considerable evidence of layering at the site reflecting erosion and deposition events from the observations and photographs. The lack of a relationship between critical erosion shear stress and vane shear strength, also suggest vertical inhomogeneity, and surface properties did not reflect the sub-surface features. This was particularly true when ridge-runnel features were smothered by a surface deposit, leaving a soft watery exposed surface which masked a persistent sub-surface topography. This is

consistent with other researchers (O'Brien and Whitehouse, in prep.) who found rapid changes in the surface topography and layering (Mitchener et al, 1996).

The results have demonstrated the value of long term measurements in assessing mudflat variability. However, to enable seasonal trends in surface stability to be resolved at such an active site, it is recommended that measurements are made at more frequent intervals to eliminate fluctuations due to weather which appeared to dominate the mudflat processes. This was clearly demonstrated by two visits in September 1997 which were separated by only two days but had very different mudflat characteristics due to different preceding climatic conditions.

## 8. ACKNOWLEDGEMENTS

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# *Tables*

**Table 1 Overview of seasonal erodibility measurements**

| Date | Survey Number | Deployments at Station A | Deployments at Station C | Deployments at Station C/D | Comments |
|---|---|---|---|---|---|
| 22/4/97 | 1 | 3 | 1 | 3 | Drainage at station C |
| 22/5/97 | 2 | 3 | 3 | 3 | Straightforward deployments |
| 19/6/97 | 3 | 3 | 3 | 2 | Drainage at station C/D |
| 22/7/97 | 4 | 3 | 3 | 1 | Drainage at station C/D |
| 19/8/97 | 5 | 3 | 3 | 2 | Tide in fast at site C/D |
| 18/9/97 | 6 | 3 | 3 | 3 | Straightforward deployments |
| 14/1/98 | 7 | 3 soft mud | 3 at B/C base clay | - | Winter survey |

**Table 2 Deployment times and conditions**

| Date | Avonmouth Low Water (local time) | Deployment Time (local) | Conditions | Daily Maximum temperature (°C) | Daily Rainfall (mm) |
|---|---|---|---|---|---|
| 22 April 1997 | 14:42 | 11:00 – 16:30 | Sunny, calm. Short shower. Hot. | 12.6 | No rain |
| 22 May 1997 | 14:49 | 11:00 – 16:30 | Dull, cloudy. Some short showers. | 10.0 | No rain |
| 19 June 1997 | 13:27 | 11:30 – 16:00 | Rainy, overcast and windy. Heavy shower | 15.6 | 2.9mm |
| 22 July 1997 | 16:31 | 13:30 – 18:30 | Very hot and sunny | 24.2 | No rain |
| 19 August 1997 | 15:33 | 13:30 – 18:00 | Sunny, hot. Some breeze later. | 25.8 | No rain |
| 18 September 1997 | 14:21 | 12:00 – 17:00 | Hot and sunny. Short shower, then windy and sunny | 21.9 | No rain |
| 14 January 1998 | 15:01 | 10:30 – 16:30 | Windy and cold. | 8.4 | No rain |

Low water times at Avonmouth signal station.
Meteorological data from Rhoose (Cardiff Airport) Station

## Table 3 Results from Survey 1 on 22 April, 1997

ERODIBILITY

| Time | Site | $\tau_A$ ($Nm^{-2}$) Lower | $\tau_B$ ($Nm^{-2}$) Upper | $\tau_{cr}$ ($Nm^{-2}$) Average | Comments |
|---|---|---|---|---|---|
| 11:12 | 1A1 | 0 | 0.25 | 0.13 | Eroded at lowest shear stress |
| 11:28 | 1A2 | 0.35 | 0.48 | 0.42 | Distinct mass erosion |
| 11:50 | 1A3 | 0.27 | 0.42 | 0.34 | Distinct mass erosion |
| 15:47 | 1C1 | 0.32 | 0.43 | 0.37 | Distinct mass erosion |
| | 1C2 | | | | No deployment, drainage through wormholes |
| | 1C3 | | | | No deployment, drainage through wormholes |
| | 1CD1 | | | | Logger failed |
| 14:07 | 1CD2 | 0.27 | 0.38 | 0.33 | Weak erosion |
| 14:25 | 1CD3 | 0.23 | 0.26 | 0.24 | Erratic erosion |

SEDIMENT PHYSICAL PROPERTIES

| Site | Bulk density ($kgm^{-3}$) | Water content (% by mass) | $d_{50}$ (microns) | Sand content (>63μm) (% by weight) | Silt content (63>x>2μm) (% by weight) | Clay content (<2μm) (% by weight) |
|---|---|---|---|---|---|---|
| 1AI | 1235 | 238 | 3.1 | 1.9 | 57.5 | 40.6 |
| 1A2 | 1227 | 250 | 2.7 | 2.5 | 52.9 | 44.6 |
| 1A3 | 1264 | 205 | 3.1 | 3.4 | 54.8 | 41.8 |
| 1C1 | 1241 | 231 | 2.1 | 2.8 | 48.3 | 48.9 |
| 1C2 | no | sample | | | | |
| 1C3 | no | sample | | | | |
| 1CD1 | 1279 | 191 | 2.1 | 2.1 | 48.4 | 49.5 |
| 1CD2 | 1258 | 212 | 2.3 | 5.8 | 47.2 | 47.0 |
| 1CD3 | 1253 | 217 | 2.2 | 3.4 | 48.7 | 47.9 |

**Table 3 (continued) Results from Survey 1 on 22 April, 1997**

SEDIMENT BIOLOGICAL PROPERTIES

| Site | Sediment temperature (degrees C) | Loss on ignition (% mass loss) | Colloidal carbohydrate content (mg/g) |
|---|---|---|---|
| 1A1 | 15.6 | 9.65 | |
| 1A2 | 15.8 | 9.83 | 2.56 |
| 1A3 | 18.8 | 9.95 | |
| 1C1 | 16.7 | 10.98 | 2.62 |
| 1C2 | no sample | | |
| 1C3 | no sample | | |
| 1CD1 | 21.6 | 10.24 | |
| 1CD2 | 22.0 | 10.39 | 2.76 |
| 1CD3 | 22.1 | 10.55 | |

**Table 4 Results from Survey 2 on 22nd May 1997**

ERODIBILITY

| Time | Site | $\tau_A$ ($Nm^{-2}$) Lower | $\tau_B$ ($Nm^{-2}$) Upper | $\tau_{cr}$ ($Nm^{-2}$) Average | Comments |
|---|---|---|---|---|---|
| 11:38 | 2A1 | 0 | 0.26 | 0.13 | Erosion from start |
| 12:00 | 2A2 | 0.31 | 0.44 | 0.38 | Weak erosion |
| 12:30 | 2A3 | 0.26 | 0.35 | 0.30 | Erosion |
| 13:45 | 2C1 | 0.41 | 0.45 | 0.43 | Erosion |
| 14:11 | 2C2 | 0.37 | 0.42 | 0.39 | Erosion |
| 14:48 | 2C3 | 0.25 | 0.36 | 0.31 | Erosion |
| 15:20 | 2CD1 | 0.38 | 0.53 | 0.46 | Medium erosion |
| 15:47 | 2CD2 | 0.37 | 0.43 | 0.40 | Medium erosion |
| 16:11 | 2CD3 | 0.26 | 0.35 | 0.30 | Medium erosion |

SEDIMENT PHYSICAL PROPERTIES

| Site | Bulk density ($kgm^{-3}$) | Water content (% by mass) | $d_{50}$ (microns) | Sand content (>63μm) (% by weight) | Silt content (63>x>2μm) (% by weight) | Clay content (<2μm) (% by weight) |
|---|---|---|---|---|---|---|
| 2A1 | 1303 | 172 | 3.3 | 0.8 | 59.1 | 40.1 |
| 2A2 | 1360 | 136 | 6.1 | 2.2 | 67.6 | 30.2 |
| 2A3 | 1350 | 141 | 6.0 | 1.8 | 67.5 | 30.7 |
| 2C1 | 1295 | 178 | 2.9 | 1.4 | 58.9 | 39.7 |
| 2C2 | 1287 | 184 | 2.6 | 0.4 | 56.4 | 45.2 |
| 2C3 | 1294 | 179 | 3.6 | 1.6 | 60.3 | 38.1 |
| 2CD1 | 1319 | 161 | 3.0 | 0.1 | 58.2 | 41.7 |
| 2CD2 | 1313 | 165 | 2.9 | 1.4 | 57.0 | 41.6 |
| 2CD3 | 1332 | 152 | 2.7 | 0.7 | 55.4 | 43.9 |

**Table 4 (Continued) Results from Survey 2 on 22nd May 1997**

SEDIMENT BIOLOGICAL PROPERTIES

| Site | Sediment temperature (degrees C) | Loss on ignition (% mass loss) | Colloidal carbohydrate content (mg/g) |
|---|---|---|---|
| 2A1 | 10.9 | 9.30 | |
| 2A2 | 10.7 | 7.39 | 0.49 |
| 2A3 | 11.1 | 7.45 | |
| 2C1 | 11.5 | 9.32 | |
| 2C2 | 12.1 | 9.51 | 1.17 |
| 2C3 | 11.6 | 9.53 | |
| 2CD1 | 10.8 | 9.28 | |
| 2CD2 | 10.9 | 9.70 | 0.71 |
| 2CD3 | 10.9 | 9.55 | |

**Table 5 Results from Survey 3 on 19th June 1997**

ERODIBILITY

| Time | Site | $\tau_A$ ($Nm^{-2}$) Lower | $\tau_B$ ($Nm^{-2}$) Upper | $\tau_{cr}$ ($Nm^{-2}$) Average | Comments |
|---|---|---|---|---|---|
| 11:32 | 3A1 | 0 | 0.25 | 0.13 | Erosion from start |
| 12:06 | 3A2 | 0.36 | 0.45 | 0.40 | Distinct mass erosion |
| 12:27 | 3A3 | 0.25 | 0.34 | 0.30 | Distinct mass erosion |
| 11:25 | 3C1 | 0.26 | 0.35 | 0.31 | Distinct mass erosion |
| 13:50 | 3C2 | 0.25 | 0.30 | 0.28 | Mass erosion only |
| 14:15 | 3C3 | 0.25 | 0.29 | 0.27 | 3 erosion phases |
| 14:47 | 3CD1 | 0.32 | 0.41 | 0.36 | Weak erosion |
| 15:10 | 3CD2 | 0.42 | 0.49 | 0.45 | Weak erosion |
| | 3CD3 | | | | Test failed due to draining through wormholes |

SEDIMENT PHYSICAL PROPERTIES

| Site | Bulk density ($kgm^{-3}$) | Water content (% by mass) | $d_{50}$ (microns) | Sand content (>63μm) (% by weight) | Silt content (63>x>2μm) (% by weight) | Clay content (<2μm) (% by weight) |
|---|---|---|---|---|---|---|
| 3A1 | 1260 | 209 | 2.9 | 1.2 | 60.3 | 38.5 |
| 3A2 | 1248 | 223 | 3.0 | 2.0 | 61.5 | 36.5 |
| 3A3 | 1254 | 217 | 3.2 | 3.6 | 55.1 | 41.3 |
| 3C1 | 1250 | 220 | 2.3 | 2.5 | 52.9 | 44.6 |
| 3C2 | 1276 | 194 | 2.4 | 1.9 | 54.7 | 43.4 |
| 3C3 | 1263 | 207 | 1.9 | 1.2 | 48.1 | 50.7 |
| 3CD1 | 1353 | 140 | 2.3 | 3.0 | 50.3 | 46.7 |
| 3CD2 | 1355 | 139 | 2.7 | 3.2 | 59.9 | 36.9 |
| 3CD3 | 1357 | 138 | 2.0 | 3.9 | 46.6 | 49.5 |

**Table 5 (Continued) Results from Survey 3 on 19th June 1997**

SEDIMENT BIOLOGICAL PROPERTIES

| Site | Sediment temperature (degrees C) | Loss on ignition (% mass loss) | Colloidal carbohydrate content (mg/g) |
|---|---|---|---|
| 3A1 | 14.5 | 8.08 | |
| 3A2 | 14.4 | 8.17 | 1.04 |
| 3A3 | 15.6 | 8.11 | |
| 3C1 | 16.4 | 8.65 | |
| 3C2 | 17.3 | 8.66 | 1.09 |
| 3C3 | 22.1 | 8.89 | |
| 3CD1 | 19.3 | 9.01 | |
| 3CD2 | 20.5 | 9.01 | 1.67 |
| 3CD3 | 19.4 | 8.94 | |

**Table 6 Results from Survey 4 on 22nd July 1997**

ERODIBILITY

| Time | Site | $\tau_A$ ($Nm^{-2}$) Lower | $\tau_B$ ($Nm^{-2}$) Upper | $\tau_{cr}$ ($Nm^{-2}$) Average | Comments |
|---|---|---|---|---|---|
| 13:41 | 4A1 | 0 | 0.22 | 0.11 | Erosion from start |
| 14:29 | 4A2 | 0.29 | 0.31 | 0.30 | Poor record |
| 15:01 | 4A3 | 0.31 | 0.36 | 0.33 | Gradual weak erosion |
| 15:51 | 4C1 | 0.30 | 0.34 | 0.32 | Benign erosion followed by massive rupture |
| 16:15 | 4C2 | 0.23 | 0.31 | 0.27 | Mass erosion |
| 16:40 | 4C3 | 0.23 | 0.30 | 0.26 | Weak erosion |
| 18:05 | 4CD1 | 0.23 | 0.26 | 0.24 | Weak erosion |
| | 4CD2 | | | | Test failed due to drainage through wormholes |
| | 4CD3 | | | | Test failed due to drainage through wormholes |

SEDIMENT PHYSICAL PROPERTIES

| Site | Bulk density ($kgm^{-3}$) | Water content (% by mass) | $d_{50}$ (microns) | Sand content (>63μm) (% by weight) | Silt content (63>x>2μm) (% by weight) | Clay content (<2μm) (% by weight) |
|---|---|---|---|---|---|---|
| 4A1 | 1226 | 251 | 2.0 | 1.8 | 47.5 | 50.7 |
| 4A2 | 1282 | 189 | 1.6 | 2.1 | 41.7 | 56.2 |
| 4A3 | 1318 | 161 | 1.9 | 1.4 | 47.4 | 51.2 |
| 4C1 | 1276 | 194 | 1.8 | 2.5 | 45.3 | 52.2 |
| 4C2 | 1287 | 184 | 1.8 | 2.2 | 45.9 | 51.9 |
| 4C3 | 1370 | 131 | 2.0 | 0.9 | 49.5 | 49.6 |
| 4CD1 | 1388 | 123 | 3.4 | 1.8 | 62.9 | 35.3 |
| 4CD2 | 1406 | 115 | 1.6 | 2.0 | 44.4 | 53.6 |
| 4CD3 | 1388 | 123 | 2.1 | 3.0 | 48.0 | 49.0 |

**Table 6 (Continued) Results from Survey 4 on 22nd July 1997**

SEDIMENT BIOLOGICAL PROPERTIES

| Site | Sediment temperature (degrees C) | Loss on ignition (% mass loss) | Colloidal carbohydrate content (mg/g) |
|---|---|---|---|
| 4A1 | 27.5 | 10.24 | |
| 4A2 | 29.0 | 9.81 | 5.47 |
| 4A3 | 28.5 | 10.11 | |
| 4C1 | 27.0 | 9.50 | |
| 4C2 | 27.0 | 9.59 | 6.48 |
| 4C3 | 27.0 | 9.15 | |
| 4CD1 | | 8.52 | |
| 4CD2 | | 9.27 | 1.72 |
| 4CD3 | | 9.54 | |

## Table 7 Results from Survey 5 on 19th August 1997

ERODIBILITY

| Time | Site | $\tau_A$ ($Nm^{-2}$) Lower | $\tau_B$ ($Nm^{-2}$) Upper | $\tau_{cr}$ ($Nm^{-2}$) Average | Comments |
|---|---|---|---|---|---|
| 13:37 | 5A1 | 0 | 0.19 | 0.10 | Weak erosion from start |
| 14:27 | 5A2 | 0.23 | 0.27 | 0.25 | Weak erosion |
| 14:51 | 5A3 | 0.19 | 0.22 | 0.21 | Medium erosion |
| 15:30 | 5C1 | 0.23 | 0.36 | 0.30 | Weak erosion |
| 15:58 | 5C2 | 0 | 0.20 | 0.10 | Erosion from start, then massive rupture |
| 16:19 | 5C3 | 0.21 | 0.31 | 0.26 | Weak erosion |
| 16:49 | 5CD1 | 0.35 | 0.38 | 0.37 | Weak erosion |
| 17:12 | 5CD2 | 0.34 | 0.37 | 0.36 | Weak erosion |
| | 5CD3 | | | | No time for measurement as tide coming in fast |

SEDIMENT PHYSICAL PROPERTIES

| Site | Bulk density ($kgm^{-3}$) | Water content (% by mass) | $d_{50}$ (microns) | Sand content (>63μm) (% by weight) | Silt content (63>x>2μm) (% by weight) | Clay content (<2μm) (% by weight) |
|---|---|---|---|---|---|---|
| 5A1 | 1196 | 301 | 1.7 | 1.1 | 45.3 | 53.6 |
| 5A2 | 1228 | 247 | 3.6 | 1.3 | 70.2 | 28.5 |
| 5A3 | 1202 | 289 | 3.7 | 1.5 | 68.9 | 29.6 |
| 5C1 | 1247 | 224 | 1.9 | 0.7 | 47.9 | 51.4 |
| 5C2 | 1250 | 221 | 3.5 | 0.5 | 69.9 | 29.6 |
| 5C3 | 1253 | 218 | 2.8 | 1.8 | 55.7 | 42.5 |
| 5CD1 | 1340 | 147 | 2.1 | 2.0 | 48.7 | 49.3 |
| 5CD2 | 1344 | 145 | 2.2 | 1.0 | 50.9 | 48.1 |
| 5CD3 | 1336 | 150 | 2.1 | 0.8 | 50.1 | 49.1 |

**Table 7 (Continued) Results from Survey 5 on 19th August 1997**

SEDIMENT BIOLOGICAL PROPERTIES

| Site | Sediment temperature (degrees C) | Loss on ignition (% mass loss) | Colloidal carbohydrate content (mg/g) |
|---|---|---|---|
| 5A1 | 30.0 | 10.93 | |
| 5A2 | 29.0 | 11.15 | 3.75 |
| 5A3 | 30.0 | 14.40 | |
| 5C1 | 29.3 | 11.89 | |
| 5C2 | 29.0 | 11.05 | 4.07 |
| 5C3 | 28.0 | 10.56 | |
| 5CD1 | 26.0 | 10.49 | |
| 5CD2 | 26.5 | 10.31 | 2.21 |
| 5CD3 | | 10.17 | |

## Table 8 Results from Survey 6 on 18th September 1997

ERODIBILITY

| Time | Site | $\tau_A$ ($Nm^{-2}$) Lower | $\tau_B$ ($Nm^{-2}$) Upper | $\tau_{cr}$ ($Nm^{-2}$) Average | Comments |
|---|---|---|---|---|---|
| 12:54 | 6A1 | 0 | 0.25 | 0.13 | Mass rupture at start |
| 13:14 | 6A2 | 0 | 0.25 | 0.13 | Mass erosion at start |
| 13:35 | 6A3 | 0 | 0.25 | 0.13 | Mass erosion at start |
| 14:24 | 6C1 | 0 | 0.27 | 0.14 | Mass erosion at start |
| 14:43 | 6C2 | 0 | 0.26 | 0.13 | Mass erosion at start |
| 15:07 | 6C3 | 0 | 0.24 | 0.12 | Weak erosion at start |
| 15:39 | 6CD1 | 0.37 | 0.42 | 0.39 | Weak erosion |
| 16:13 | 6CD2 | 0.28 | 0.33 | 0.31 | Weak erosion |
| 16:37 | 6CD3 | 0.25 | 0.28 | 0.27 | Weak erosion |

SEDIMENT PHYSICAL PROPERTIES

| Site | Bulk density ($kgm^{-3}$) | Water content (% by mass) | $d_{50}$ (microns) | Sand content (>63μm) (% by weight) | Silt content (63>x>2μm) (% by weight) | Clay content (<2μm) (% by weight) |
|---|---|---|---|---|---|---|
| 6A1 | 1174 | 348 | 1.5 | 2.0 | 43.4 | 54.6 |
| 6A2 | 1174 | 348 | 1.5 | 1.3 | 43.5 | 55.2 |
| 6A3 | 1194 | 303 | 1.9 | 1.9 | 47.3 | 50.8 |
| 6C1 | 1223 | 256 | 2.1 | 0.3 | 50.8 | 48.9 |
| 6C2 | 1232 | 243 | 1.9 | 1.9 | 47.0 | 51.1 |
| 6C3 | 1234 | 240 | 1.8 | 2.0 | 46.0 | 52.0 |
| 6CD1 | 1332 | 152 | 2.8 | 1.4 | 54.9 | 43.7 |
| 6CD2 | 1356 | 138 | 2.8 | 3.9 | 51.7 | 44.4 |
| 6CD3 | 1358 | 137 | 2.4 | 3.3 | 49.7 | 47.0 |

**Table 8 (Continued) Results from Survey 6 on 18th September 1997**

SEDIMENT BIOLOGICAL PROPERTIES

| Site | Sediment temperature (degrees C) | Loss on ignition (% mass loss) | Colloidal carbohydrate content (mg/g) |
|---|---|---|---|
| 6A1 | 22.0 | 10.89 | |
| 6A2 | 23.0 | 10.60 | 1.83 |
| 6A3 | 24.0 | 11.67 | |
| 6C1 | 23.0 | 11.43 | |
| 6C2 | 22.5 | 10.78 | 2.21 |
| 6C3 | 24.0 | 9.75 | |
| 6CD1 | 22.0 | 9.42 | |
| 6CD2 | 23.5 | 8.84 | 2.81 |
| 6CD3 | 22.0 | 8.65 | |

**Table 9 Results from Survey 7 on 14th January 1998**

ERODIBILITY

| Time | Site | $\tau_A$ ($Nm^{-2}$) Lower | $\tau_B$ ($Nm^{-2}$) Upper | $\tau_{cr}$ ($Nm^{-2}$) Average | Comments |
|---|---|---|---|---|---|
| 10:58 | 7A1 | 0 | 0.25 | 0.13 | Mass rupture at start |
| 11:37 | 7A2 | 0 | 0.25 | 0.13 | Mass erosion at start |
| 12:02 | 7A3 | 0 | 0.25 | 0.13 | Mass erosion at start |
| 12:52 | 7BC1 | 0 | 0.27 | 0.14 | Mass erosion at start |
| 13:34 | 7BC2 | 0 | 0.26 | 0.13 | Mass erosion at start |
| 14:19 | 7BC3 | 0 | 0.24 | 0.12 | Weak erosion at start |

SEDIMENT PHYSICAL PROPERTIES

| Site | Bulk density ($kgm^{-3}$) | Water content (% by mass) | $d_{50}$ (microns) | Sand content (>63μm) (% by weight) | Silt content (63>x>2μm) (% by weight) | Clay content (<2μm) (% by weight) |
|---|---|---|---|---|---|---|
| 7A1 | 1255 | 215 | 4.6 | 0.0 | 78.0 | 22.0 |
| 7A2 | 1251 | 220 | 4.4 | 0.0 | 76.0 | 24.0 |
| 7A3 | 1248 | 223 | 4.7 | 0.0 | 79.0 | 21.0 |
| 7BC1 | 1448 | 100 | 5.0 | 0.0 | 75.0 | 25.0 |
| 7BC2 | 1496 | 86 | 5.1 | 0.0 | 74.0 | 26.0 |
| 7BC3 | 1602 | 63 | 4.4 | 0.0 | 72.0 | 28.0 |

SEDIMENT BIOLOGICAL PROPERTIES

| Site | Sediment temperature (degrees C) | Loss on ignition (% mass loss) | Colloidal carbohydrate content (mg/g) |
|---|---|---|---|
| 7A1 | 8.0 | 10.02 | |
| 7A2 | 8.5 | 9.08 | 0.489 |
| 7A3 | 8.0 | 10.05 | |
| 7BC1 | 9.0 | 6.69 | |
| 7BC2 | 8.0 | 6.90 | 0.542 |
| 7BC3 | 8.0 | 6.35 | |

## Table 10 Averaged data for the Cardiff seasonal survey

Triplicate data for surface sediment properties except for carbohydrate where there is one determination for each station and critical shear stress where available data is averaged

| Date | Deployment | Sediment Temp. (°C) | Vane Shear Strength (kPa) | Water Content (%) | Bulk Density ($kgm^{-3}$) | LOI (%) | Colloidal Carbohydrate (mg/g) | Median size (μm) | Fraction > 63μm (% sand ) | Fraction 63>x>2μm (% silt) | Fraction <2μm (% clay) | Critical Shear Stress ($Nm^{-2}$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site A | | | | | | | Site A | | | | | |
| 18/04/97 | 1A | 16.7 | 0.5 | 231.2 | 1242 | 9.81 | 2.56 | 2.95 | 2.60 | 55.07 | 42.33 | 0.30 |
| 22/05/97 | 2A | 10.9 | 0.8 | 150.0 | 1337 | 8.05 | 0.49 | 5.09 | 1.60 | 64.73 | 33.67 | 0.27 |
| 19/06/97 | 3A | 14.8 | 0.9 | 216.3 | 1254 | 8.12 | 1.04 | 3.00 | 2.27 | 58.97 | 38.77 | 0.28 |
| 22/07/97 | 4A | 28.3 | 1.0 | 200.5 | 1275 | 10.06 | 5.47 | 1.81 | 1.77 | 45.53 | 52.70 | 0.24 |
| 19/08/97 | 5A | 29.7 | 1.3 | 279.2 | 1209 | 12.16 | 3.75 | 2.98 | 1.30 | 61.47 | 37.23 | 0.19 |
| 18/09/97 | 6A | 23.0 | 0.9 | 333.4 | 1181 | 11.05 | 1.83 | 1.66 | 1.73 | 44.73 | 53.53 | 0.13 |
| 14/01/98 | 7A | 8.2 | 5.6 | 219.5 | 1251 | 9.72 | | 4.65 | 0.00 | 77.67 | 22.33 | 0.20 |
| Site B/C | | | | | | | Site B/C | | | | | |
| 14/01/98 | 7BC | 8.3 | 16.8 | 82.7 | 1516 | 6.64 | | 4.81 | 0.00 | 73.67 | 26.33 | 0.30 |
| Site C | | | | | | | Site C | | | | | |
| 18/04/97 | 1C | 16.7 | 0.1 | 231.3 | 1241 | 10.98 | 2.62 | 2.11 | 2.80 | 48.30 | 48.90 | 0.37 |
| 22/05/97 | 2C | 11.7 | 0.3 | 180.5 | 1292 | 9.45 | 1.17 | 3.02 | 1.13 | 57.87 | 41.00 | 0.38 |
| 19/06/97 | 3C | 18.6 | 0.6 | 207.1 | 1263 | 8.73 | 1.09 | 2.22 | 1.87 | 51.90 | 46.23 | 0.29 |
| 22/07/97 | 4C | 27.0 | 0.7 | 169.9 | 1311 | 9.42 | 6.48 | 1.88 | 1.87 | 46.90 | 51.23 | 0.28 |
| 19/08/97 | 5C | 28.8 | 0.9 | 220.9 | 1250 | 11.17 | 4.07 | 2.69 | 1.00 | 57.83 | 41.17 | 0.22 |
| 18/09/97 | 6C | 23.2 | 1.0 | 246.0 | 1230 | 10.65 | 2.21 | 1.92 | 1.40 | 47.93 | 50.67 | 0.13 |
| Site CD | | | | | | | Site CD | | | | | |
| 18/04/97 | 1CD | 21.9 | 0.4 | 206.6 | 1264 | 10.39 | 2.76 | 2.20 | 3.77 | 48.10 | 48.13 | 0.29 |
| 22/05/97 | 2CD | 10.9 | 1.1 | 159.2 | 1321 | 9.51 | 0.71 | 2.88 | 0.73 | 56.87 | 42.40 | 0.39 |
| 19/06/97 | 3CD | 19.7 | 1.2 | 139.0 | 1355 | 8.98 | 1.67 | 2.32 | 3.37 | 52.27 | 44.37 | 0.41 |
| 22/07/97 | 4CD | | 1.8 | 120.4 | 1394 | 9.11 | 1.72 | 2.37 | 2.27 | 51.77 | 45.97 | 0.24 |
| 19/08/97 | 5CD | 26.3 | 1.6 | 146.1 | 1342 | 10.40 | 2.21 | 2.12 | 1.27 | 49.90 | 48.83 | 0.37 |
| 18/09/97 | 6CD | 22.5 | 1.4 | 142.6 | 1349 | 8.97 | 2.81 | 2.67 | 2.87 | 52.10 | 45.03 | 0.32 |

## Table 11 Standard deviation data for the Cardiff seasonal survey

For triplicate sediment property data only (no carbohydrate or critical shear stress values given)

| Date | Deployment | Sediment Temp. (°C) | Vane Shear Strength (kPa) | Water Content (%) | Bulk Density ($kgm^{-3}$) | LOI (%) | Median size (μm) | Fraction > 63μm (% sand ) | Fraction 63>x>2μm (% silt) | Fraction <2μm (% clay) |
|---|---|---|---|---|---|---|---|---|---|---|
| Site A | | | | | | | | | | |
| 18/04/97 | 1A | 1.8 | 0.3 | 23.1 | 20 | 0.15 | 0.24 | 0.75 | 2.31 | 2.05 |
| 22/05/97 | 2A | 0.2 | 0.2 | 19.3 | 31 | 1.08 | 1.58 | 0.72 | 4.88 | 5.58 |
| 19/06/97 | 3A | 0.7 | 0.0 | 6.8 | 6 | 0.05 | 0.15 | 1.22 | 3.40 | 2.41 |
| 22/07/97 | 4A | 0.8 | 0.1 | 46.0 | 46 | 0.22 | 0.22 | 0.35 | 3.32 | 3.04 |
| 19/08/97 | 5A | 0.6 | 0.2 | 28.2 | 17 | 1.95 | 1.15 | 0.20 | 14.02 | 14.18 |
| 18/09/97 | 6A | 1.0 | 0.2 | 26.1 | 12 | 0.55 | 0.23 | 0.38 | 2.22 | 2.39 |
| 14/01/98 | 7A | 0.3 | 3.6 | 4.0 | 4 | 0.56 | 0.28 | 0.00 | 1.53 | 1.53 |
| Site C | | | | | | | | | | |
| 18/04/97 | 1C | | | | | | | | | |
| 22/05/97 | 2C | 0.3 | 0.1 | 3.2 | 4 | 0.11 | 0.52 | 0.64 | 3.08 | 3.72 |
| 19/06/97 | 3C | 3.1 | 0.1 | 13.3 | 13 | 0.14 | 0.26 | 0.65 | 3.41 | 3.91 |
| 22/07/97 | 4C | 0.0 | 0.3 | 33.7 | 51 | 0.23 | 0.14 | 0.85 | 2.27 | 1.42 |
| 19/08/97 | 5C | 0.7 | 0.3 | 3.3 | 3 | 0.67 | 0.80 | 0.70 | 11.15 | 10.96 |
| 18/09/97 | 6C | 0.8 | 0.1 | 8.5 | 6 | 0.85 | 0.19 | 0.95 | 2.53 | 1.59 |
| 14/01/98 | 7BC | 0.6 | 2.0 | 18.7 | 79 | 0.28 | 0.33 | 0.00 | 1.53 | 1.53 |
| Site CD | | | | | | | | | | |
| 18/04/97 | 1CD | 0.3 | 0.3 | 13.7 | 14 | 0.16 | 0.14 | 1.88 | 0.79 | 1.27 |
| 22/05/97 | 2CD | 0.1 | 0.0 | 6.2 | 10 | 0.21 | 0.19 | 0.65 | 1.40 | 1.30 |
| 19/06/97 | 3CD | 0.7 | 0.2 | 1.2 | 2 | 0.04 | 0.33 | 0.47 | 6.86 | 6.62 |
| 22/07/97 | 4CD | | 0.1 | 4.3 | 10 | 0.53 | 0.93 | 0.64 | 9.81 | 9.52 |
| 19/08/97 | 5CD | 0.4 | 0.2 | 1.8 | 3 | 0.13 | 0.07 | 0.64 | 1.11 | 0.64 |
| 18/09/97 | 6CD | 0.87 | 0.139 | 8.2 | 14 | 0.40 | 0.23 | 1.31 | 2.62 | 1.74 |

## Table 12 Cardiff seasonal data intercomparisons

Intercomparisons based on average data.

| Independent Variable (X) | Dependant Variable(Y) | Relationship Character | Equation | $R^2$ |
|---|---|---|---|---|
| Sediment temperature (deg C) | Colloidal carbohydrate (mg/g) | Carbohydrate content increases with sediment temperature | y=0.1965x-1.5051 | 0.64 |
| Water content (%) | Critical shear stress ($Nm^{-2}$) | Critical shear stress decreases with water content | y=-0.001x+0.4765 | 0.42 |
| Sediment temperature (deg C) | LOI (% mass loss) | LOI increases with sediment temperature | y=0.1112x+7.583 | 0.38 |
| Bulk density ($kgm^{-3}$) | Critical shear stress ($Nm^{-2}$) | Critical shear stress increases with bulk density | y=0.0008x-0.7533 | 0.32 |
| Sediment temperature (deg C) | Critical shear stress ($Nm^{-2}$) | Critical shear stress decreases with sediment temperature | y=-0.0064x+0.4174 | 0.23 |
| LOI (% mass loss) | Colloidal carbohydrate (mg/g) | Colloidal carbohydrate increases with LOI | y=0.6093x-3.555 | 0.22 |
| Sediment temperature (deg C) | Vane shear strength (kPa) | Vane shear strength increases with sediment temperature | y=0.0262x+0.318 | 0.17 |
| LOI (% mass loss) | Critical shear stress ($Nm^{-2}$) | Critical shear stress decreases with LOI | y=-0.0298x+0.5749 | 0.16 |
| Vane shear strength (kPa) | Critical shear stress ($Nm^{-2}$) | None | | |

# Figures

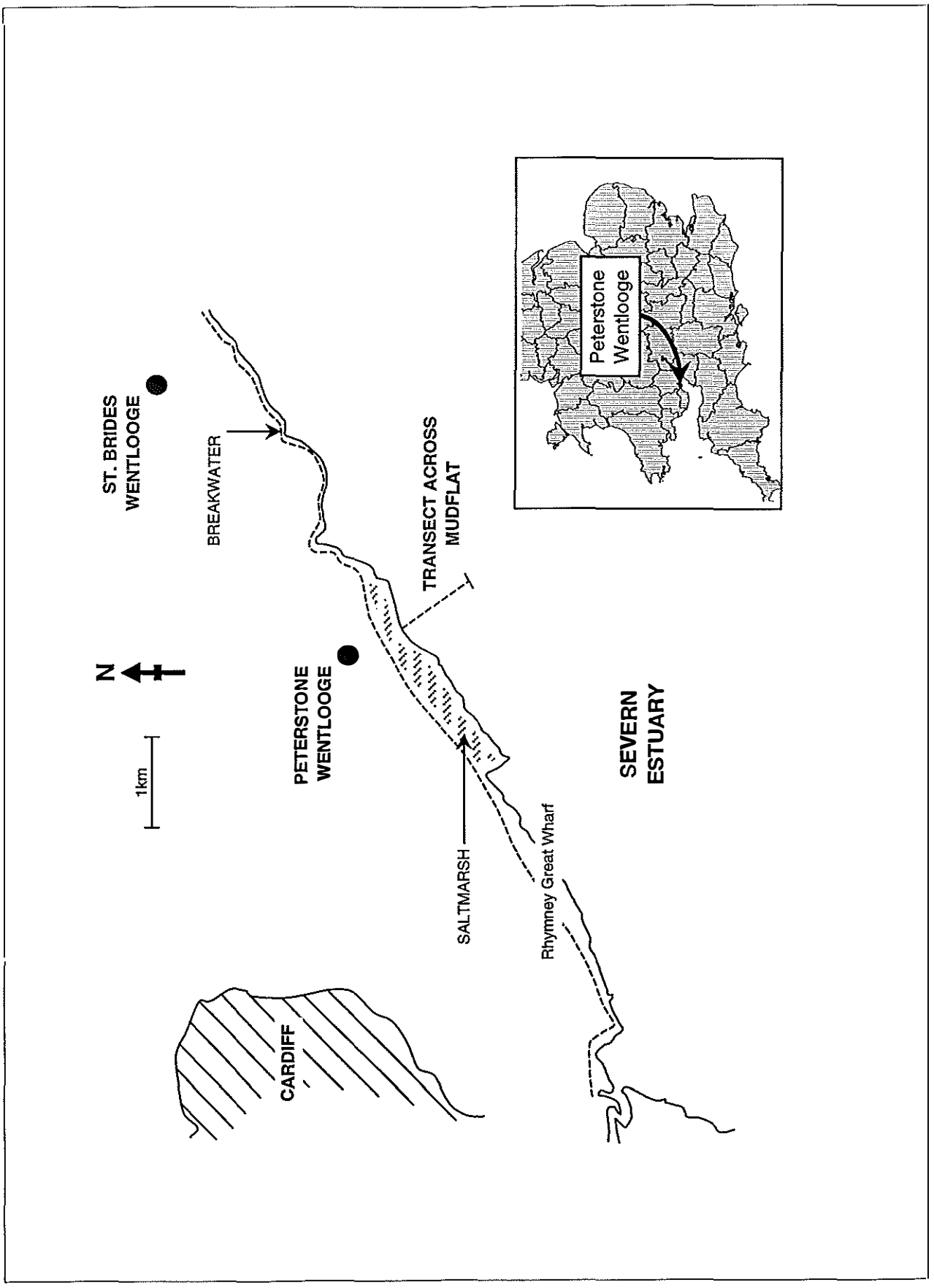



**Figure 1 Peterstone Wentlooge mudflat general location plan**

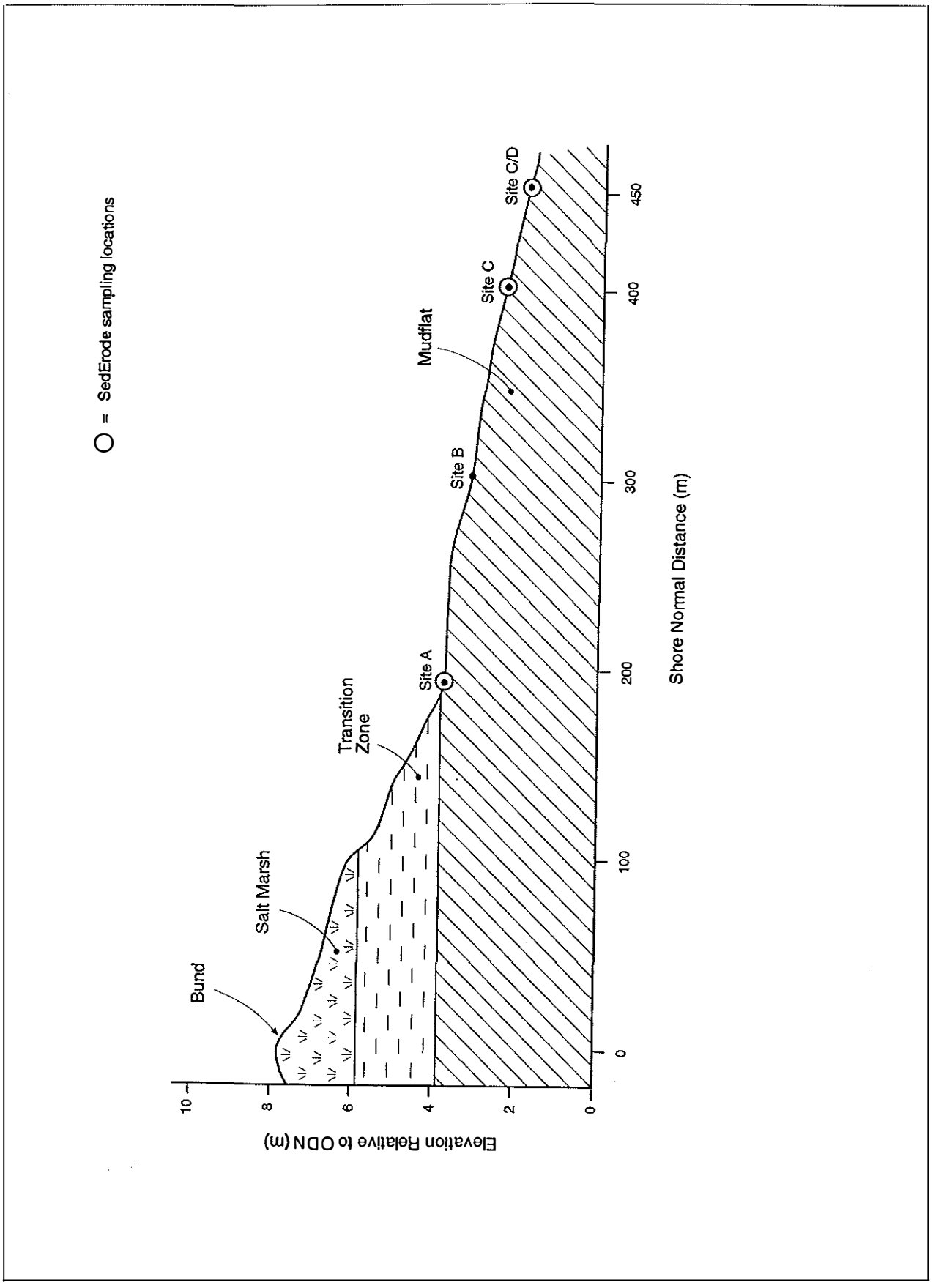



**Figure 2 Erodibility seasonal survey sampling locations**

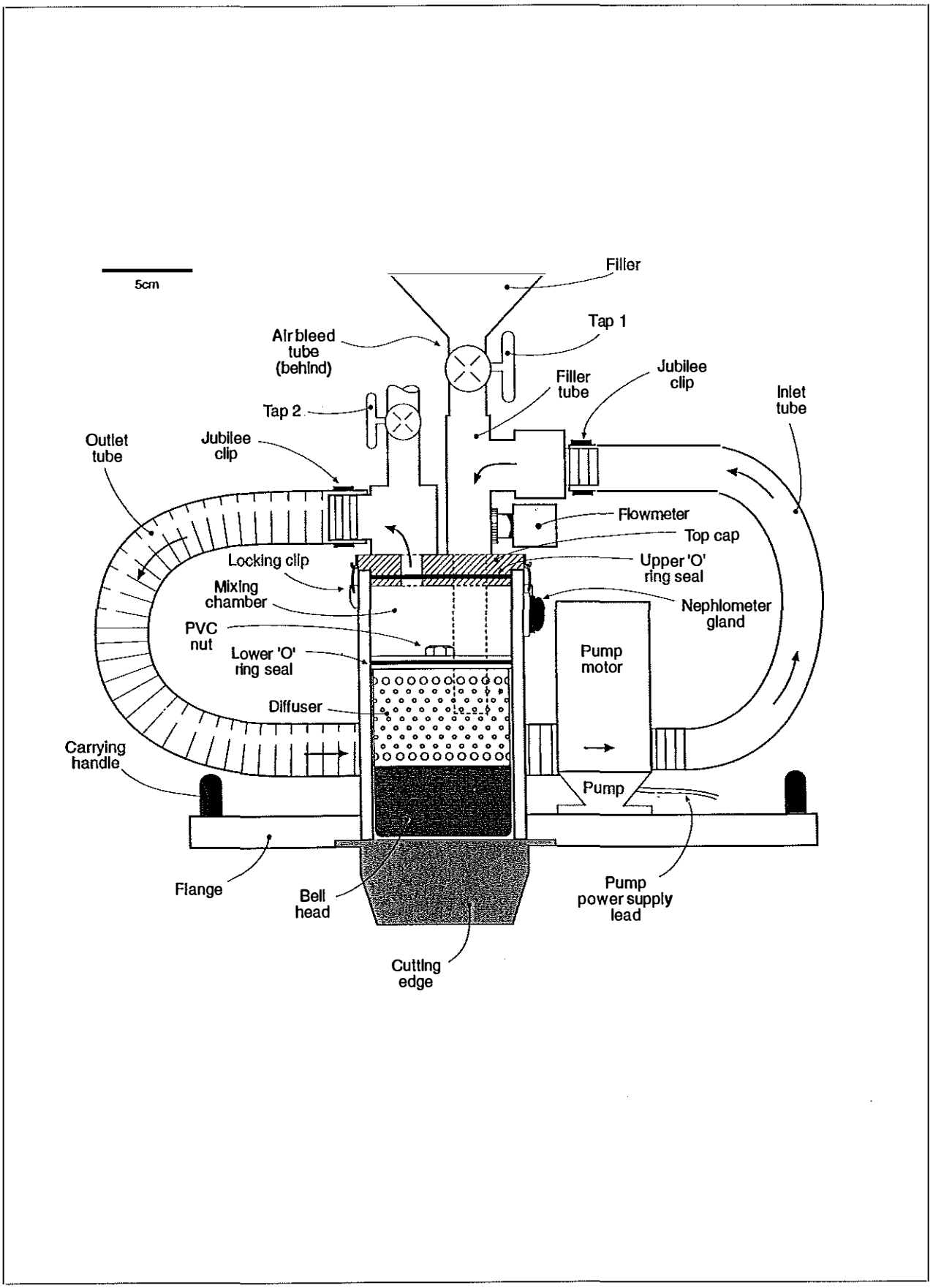
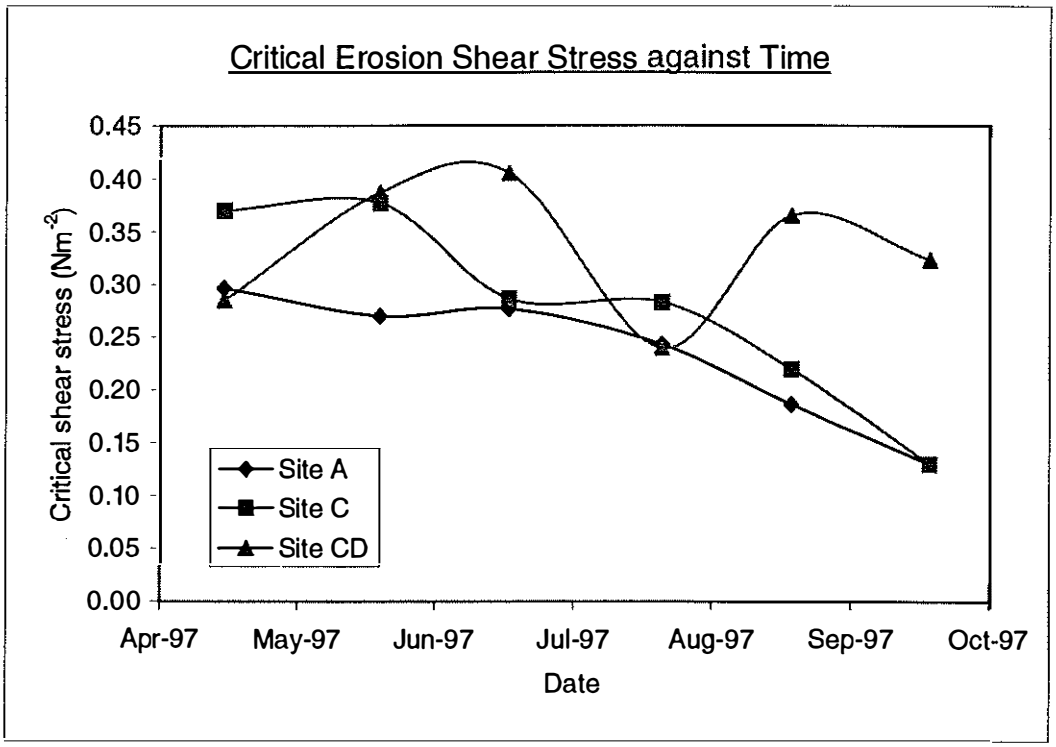



**Figure 3 SedErode head unit**



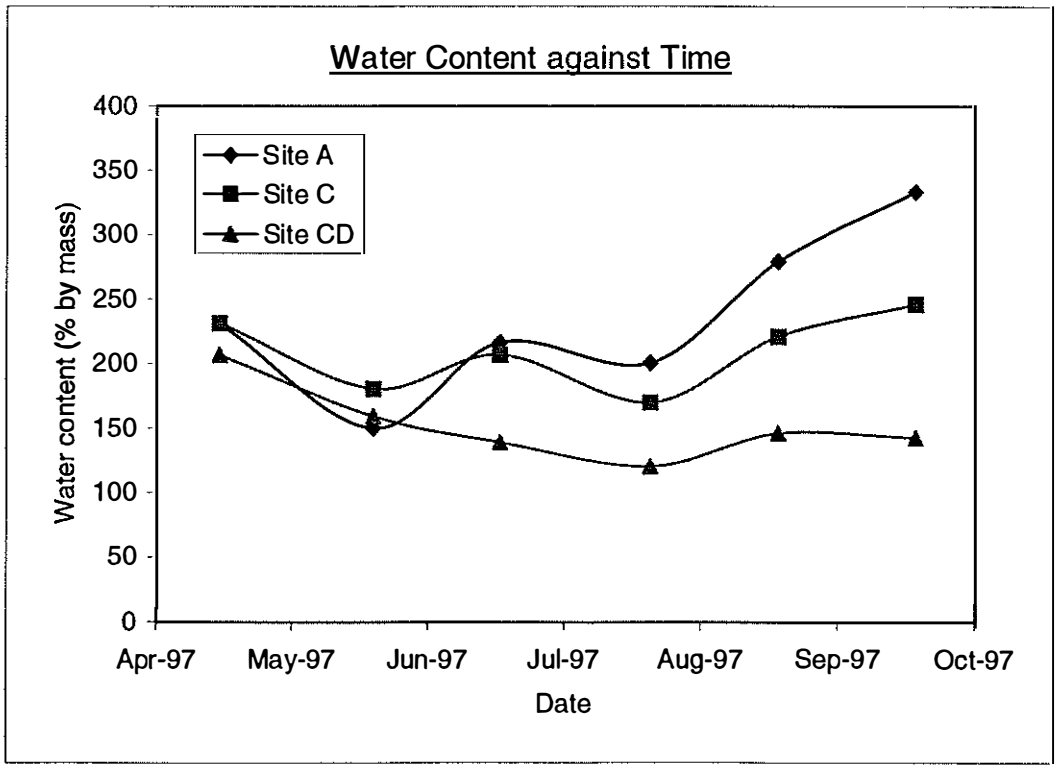
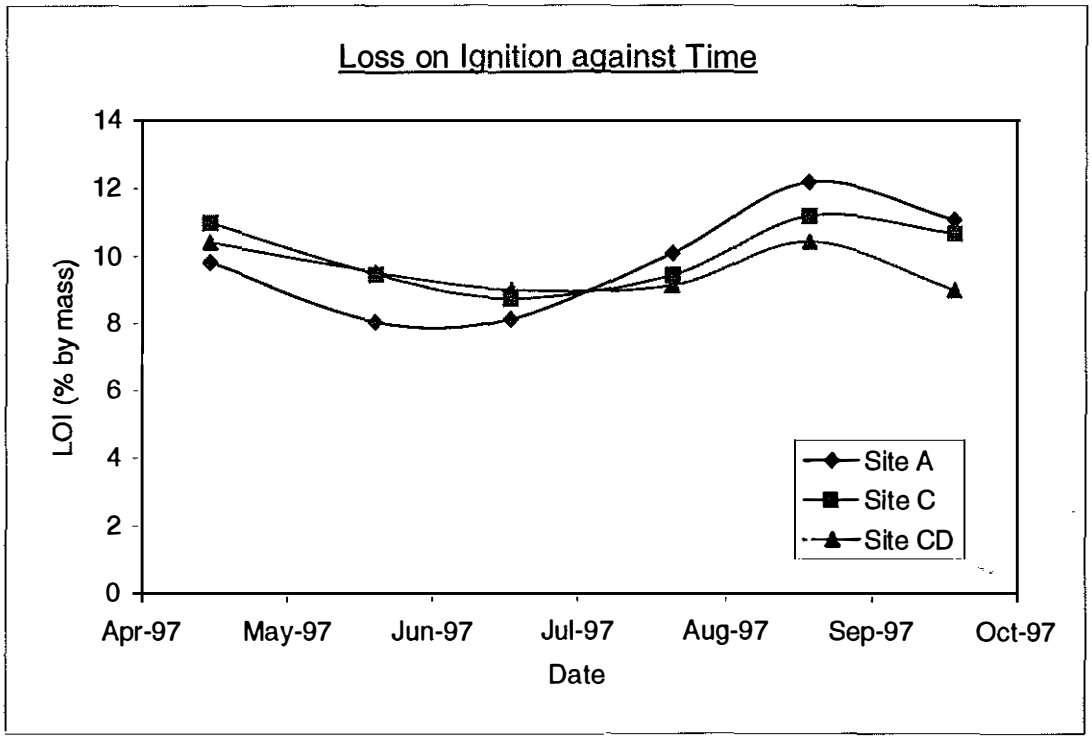




**Figure 4 Time series of critical erosion shear stress and surface sediment water content**



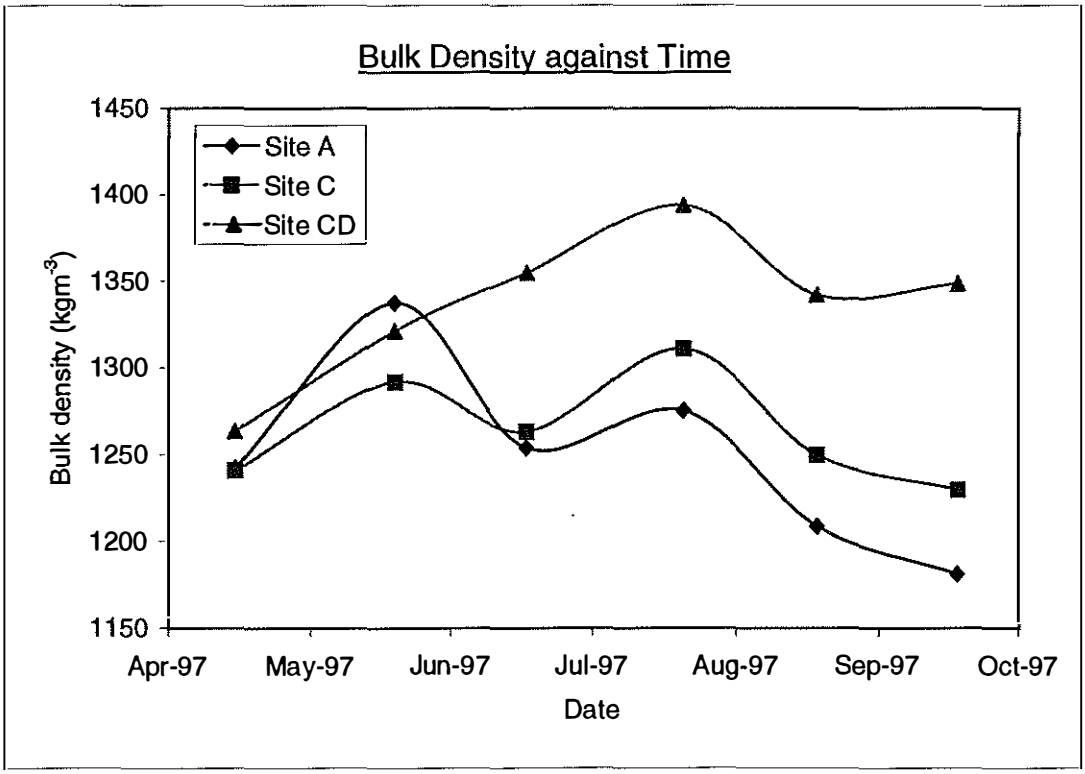
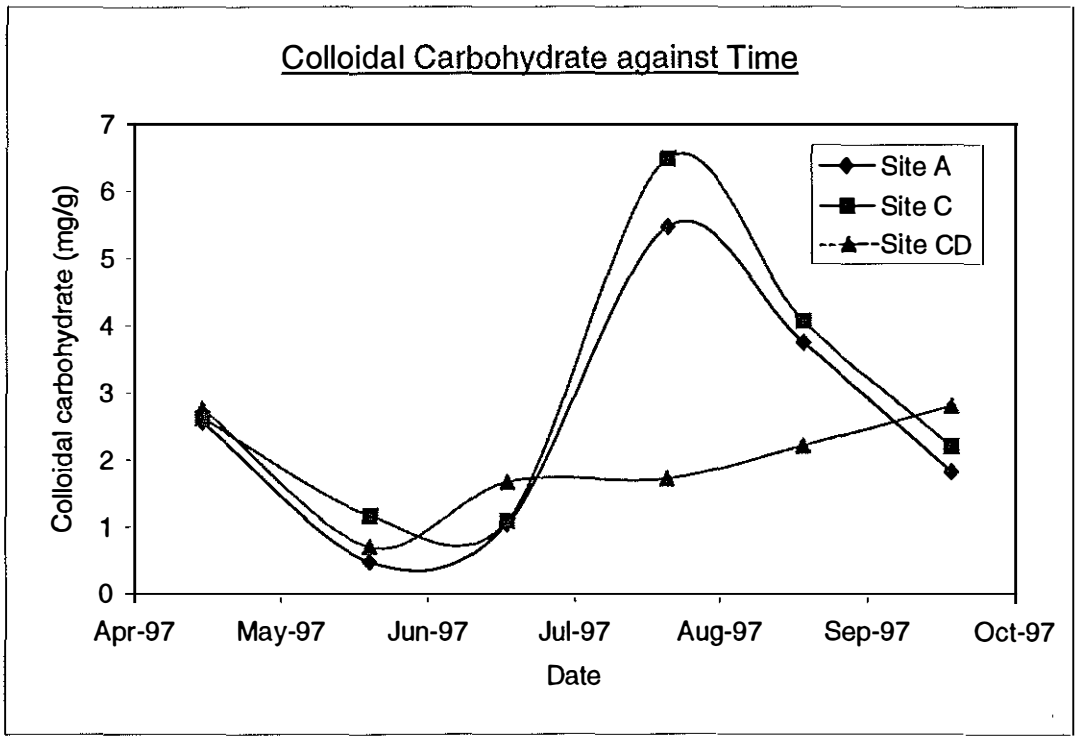




**Figure 5 Time series of surface sediment loss on ignition and bulk density**



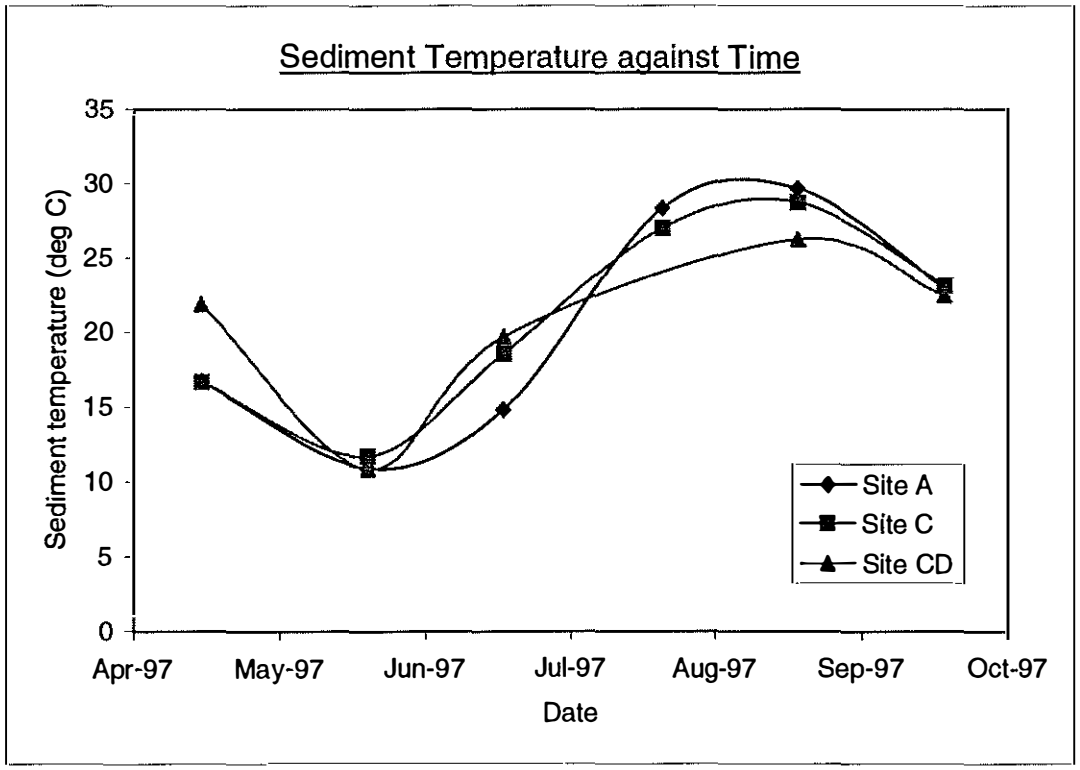
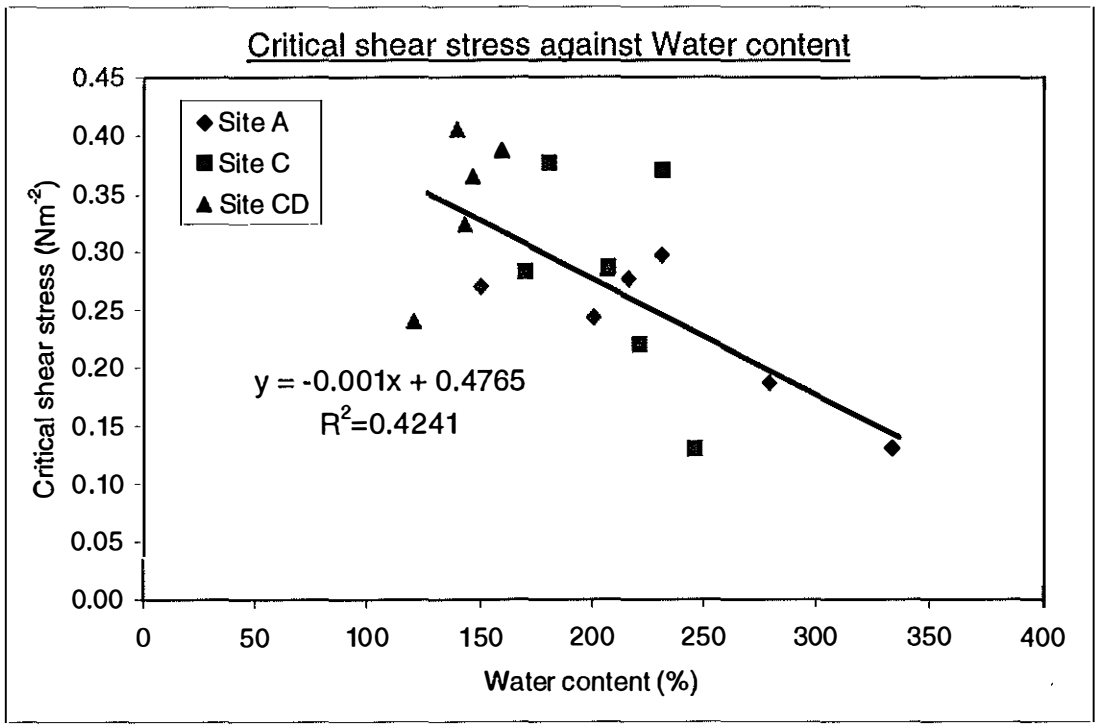




**Figure 6 Time series of surface sediment colloidal carbohydrate and temperature**



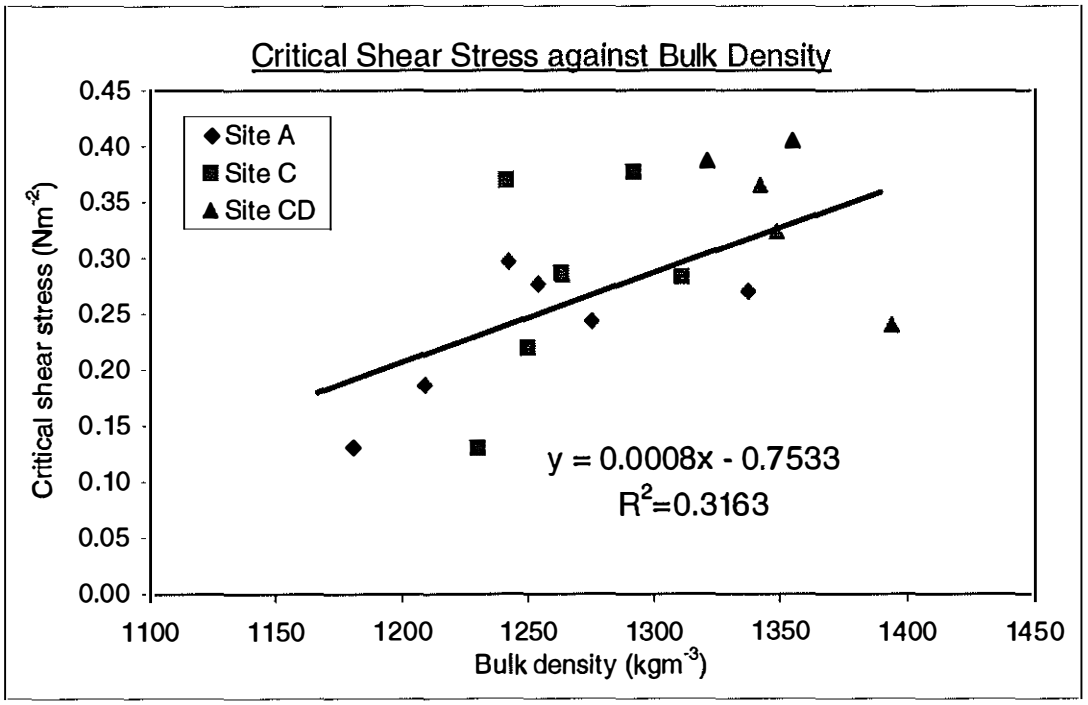
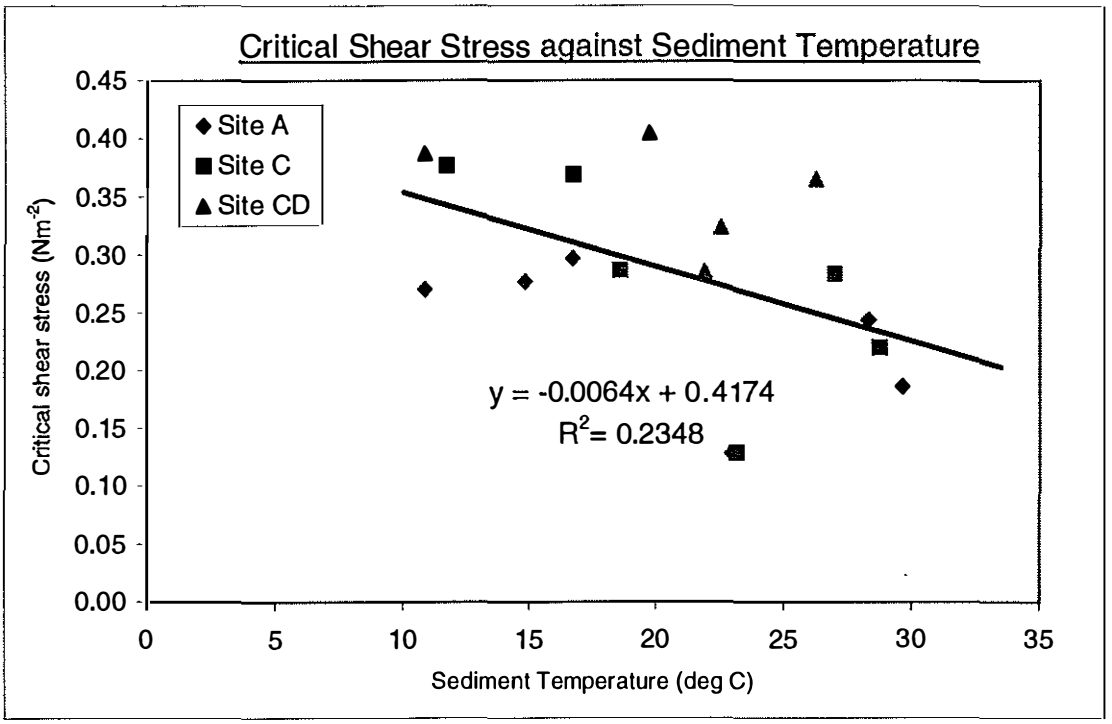




**Figure 7 Critical erosion shear stress against sediment water content and bulk density**



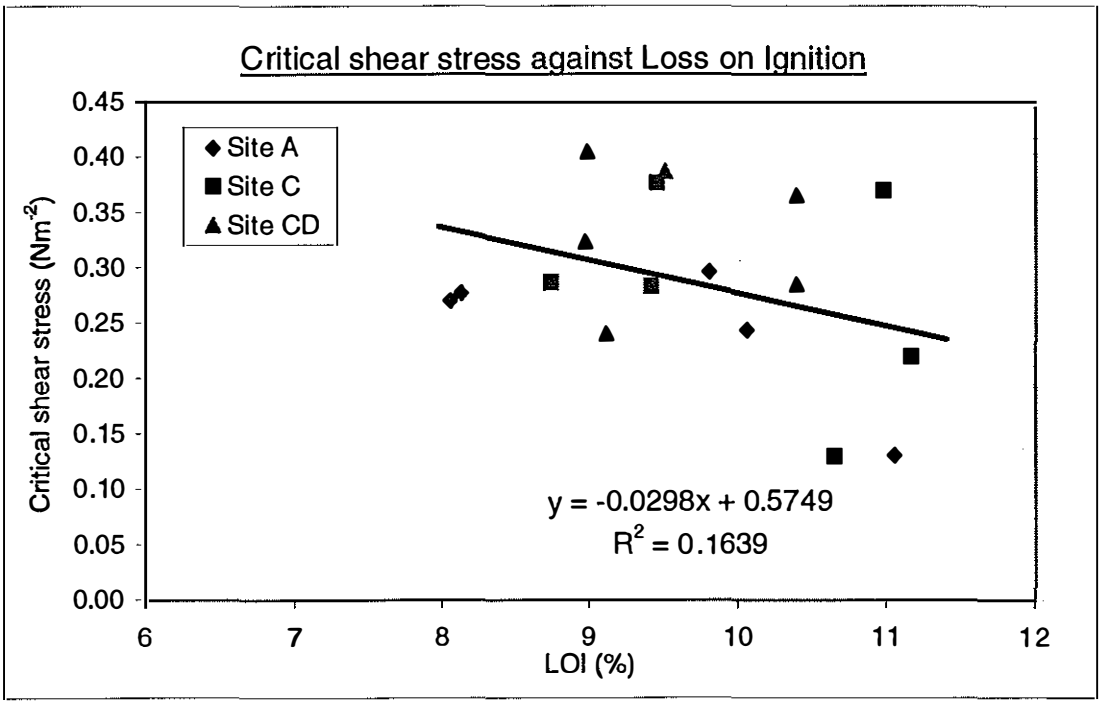




**Figure 8 Critical erosion shear stress against sediment temperature and loss on ignition**

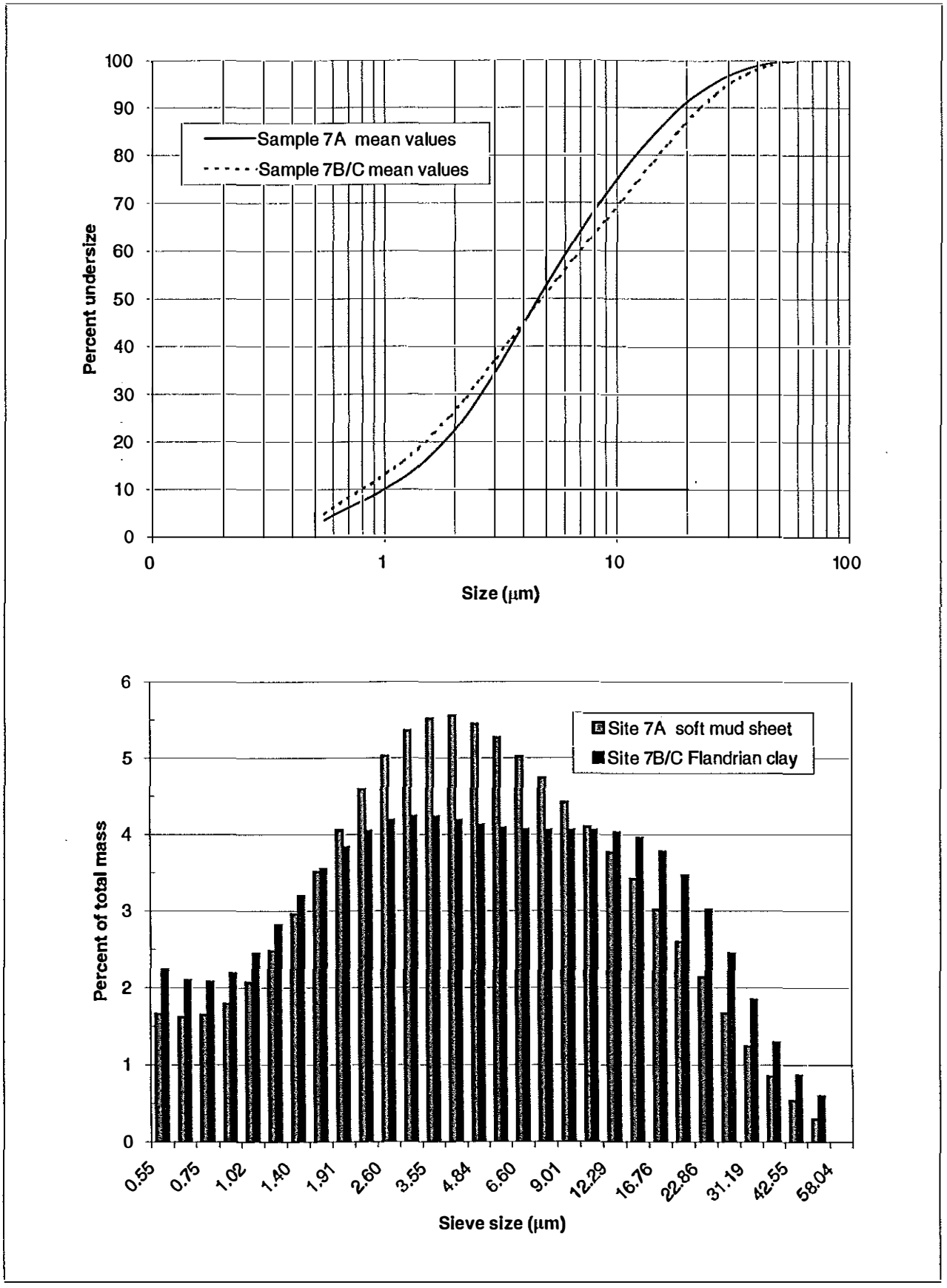
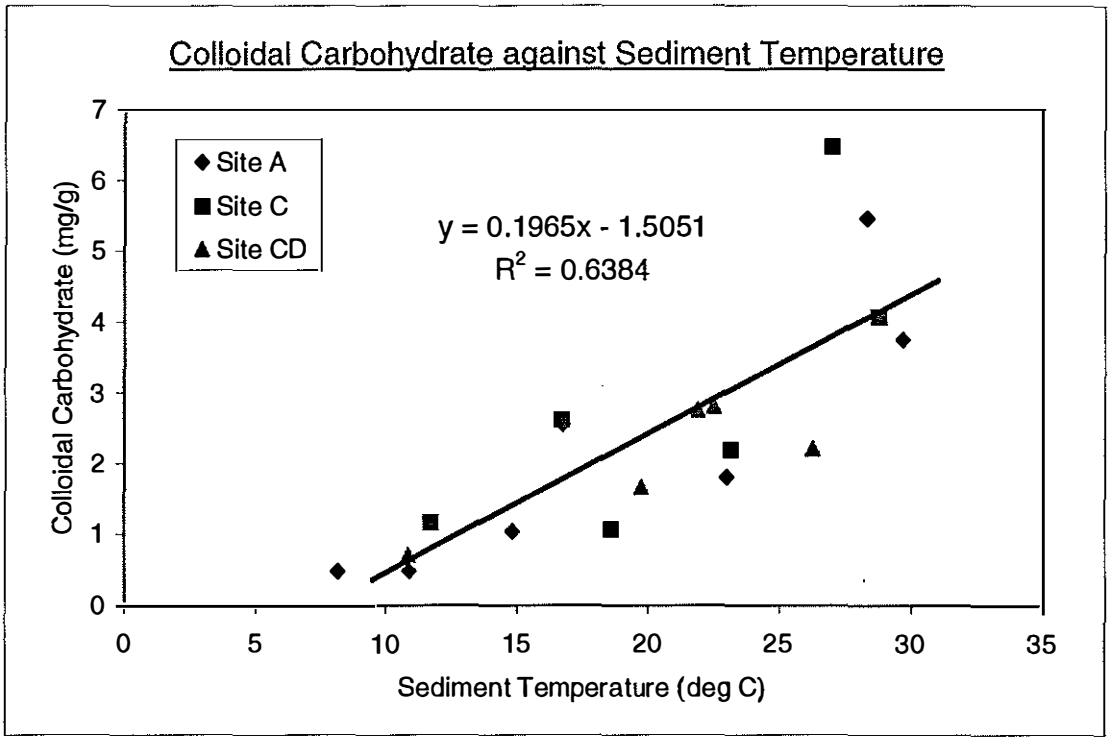



**Figure 9** **Grain size distribution plots for site A (soft mud sheet) and site B/C (Flandrian clay) on 14 January 1998**



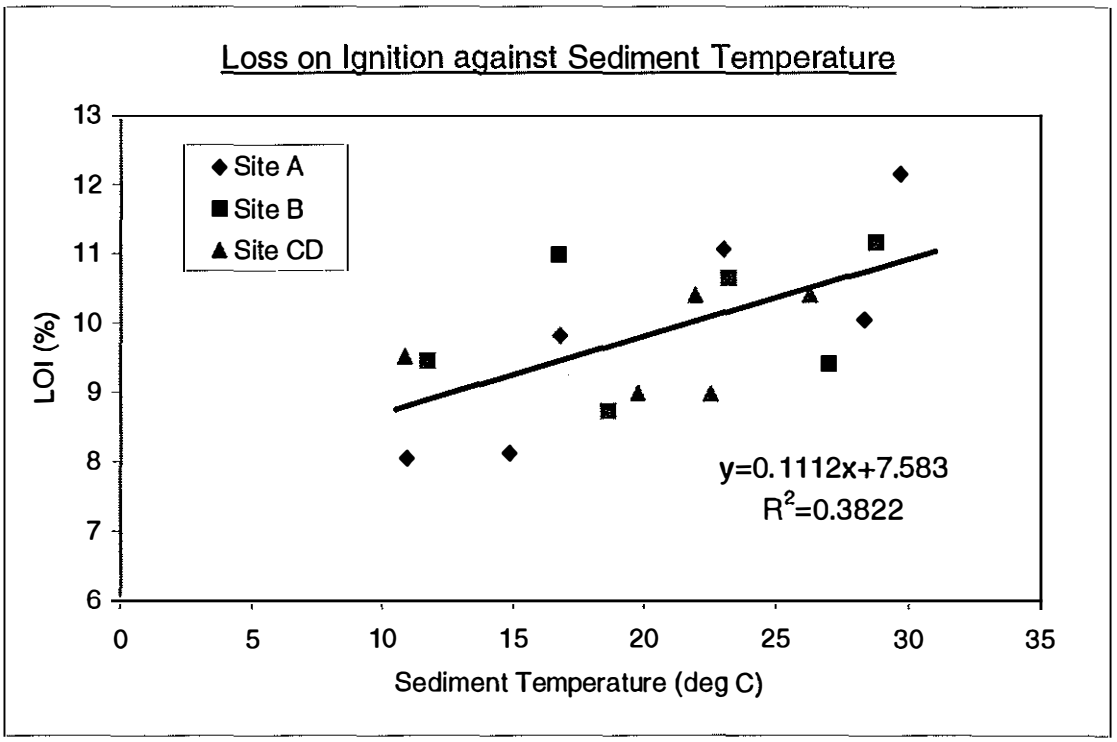




**Figure 10 Colloidal carbohydrate and loss on ignition against sediment temperature**

# Plates

**Plate 1 Peterstone Wentlooge general site**

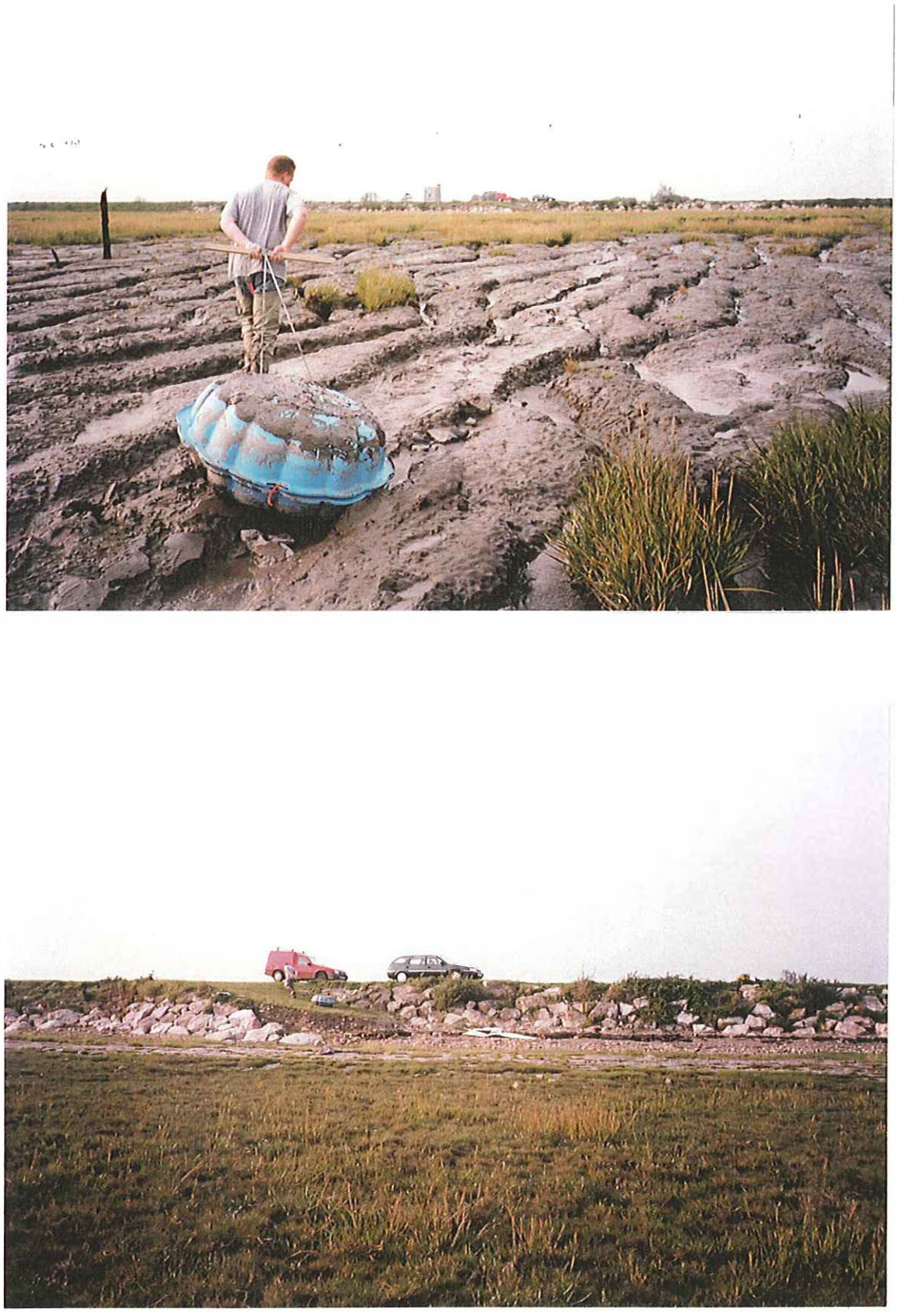


**Plate 2 Transition zone, saltmarsh and bund**

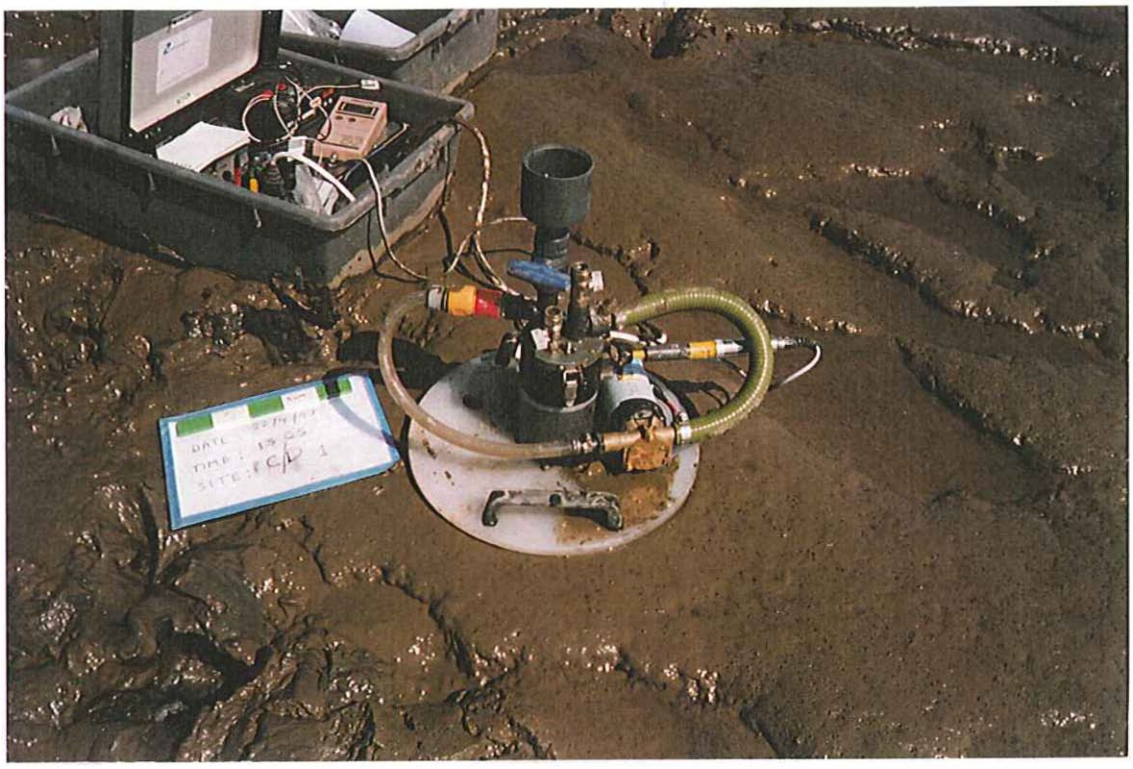


**Plate 3** **SedErode at site 1C/D1 April 1997, and at site B, looking onshore January 1998**

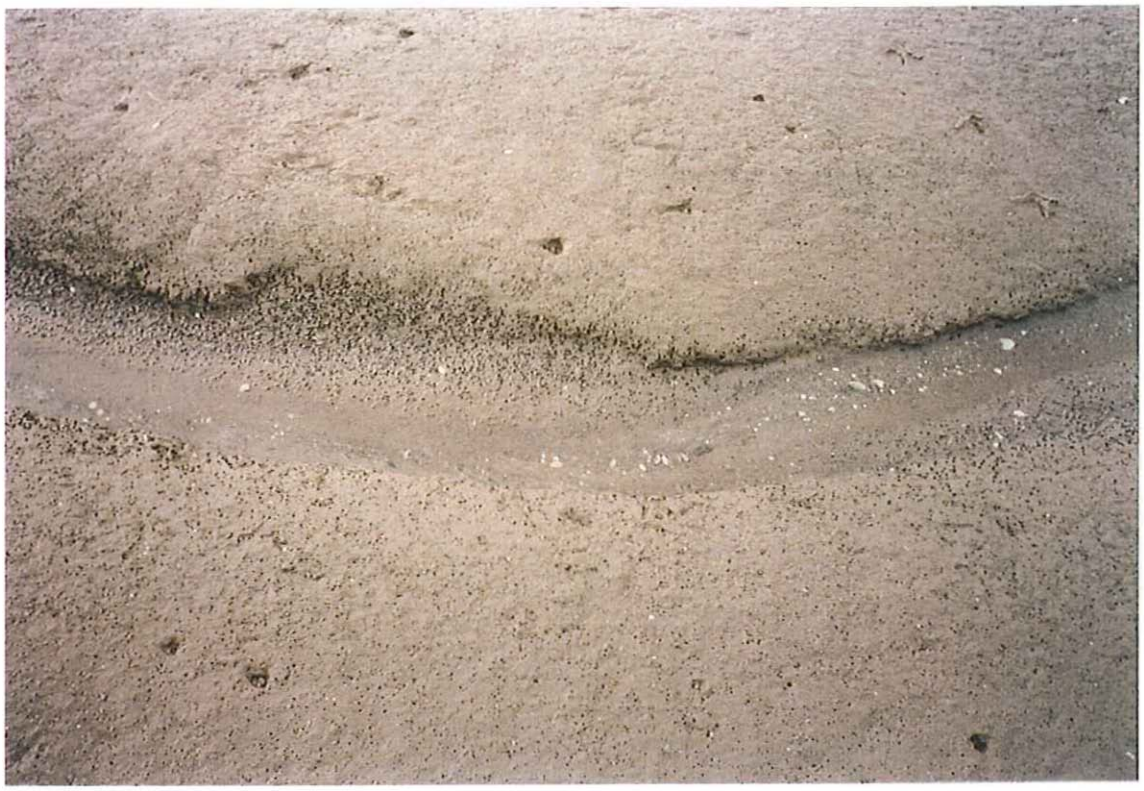


**Plate 4** **Main drainage runnels and bank collapse on 16 and 18 September 1997**

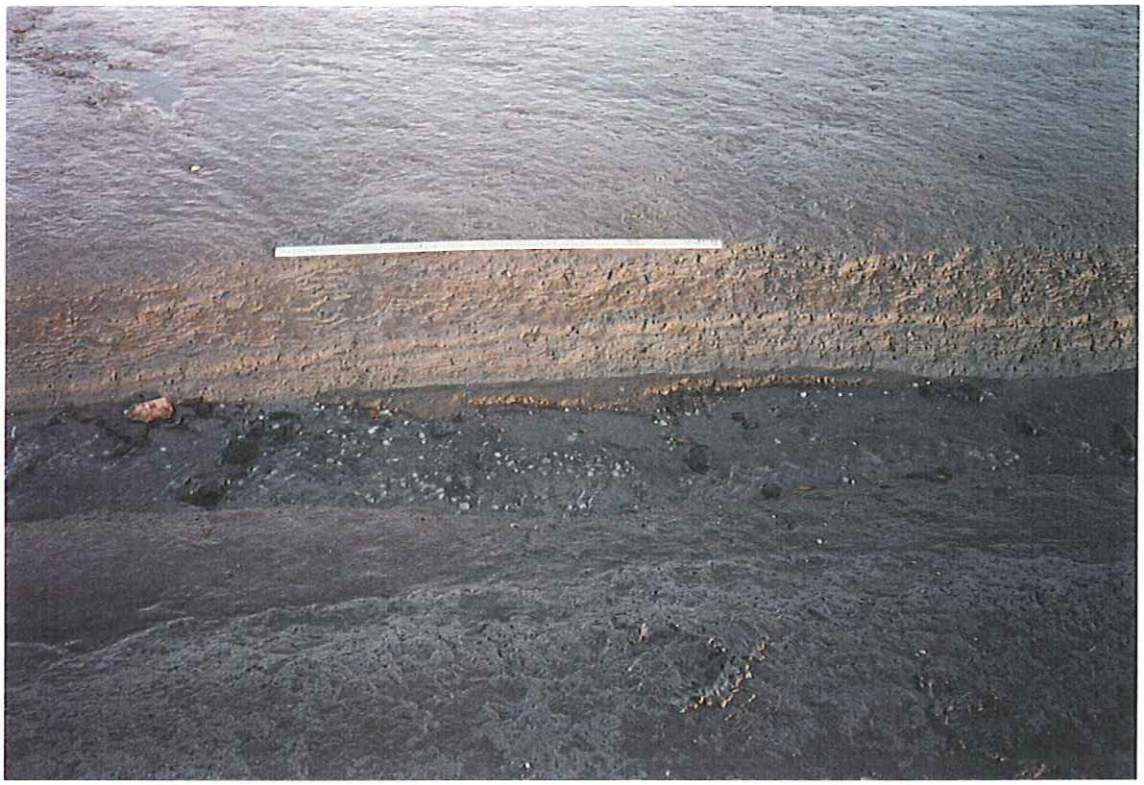


**Plate 5** **Exposed Flandrian base clay and surface features at station C/D and runnel bank layering.**

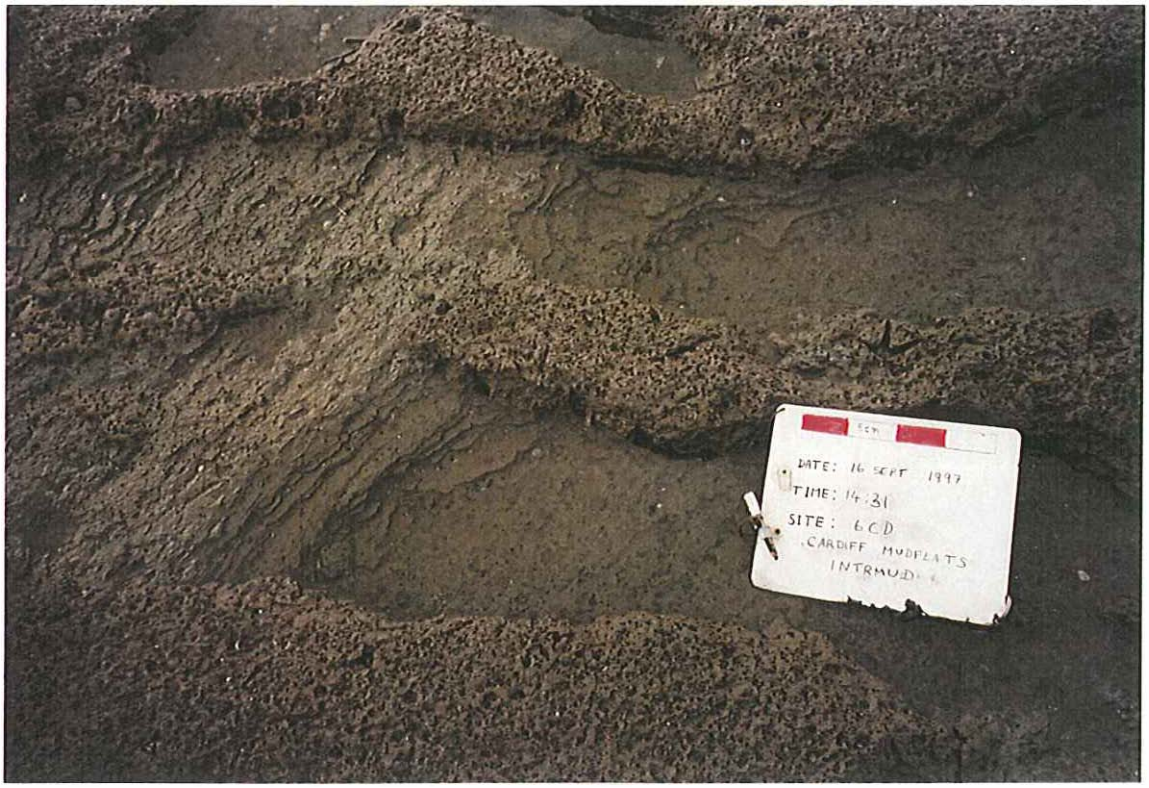



**Plate 6** **Layering features at site C/D September 1997, showing exposed Flandrian clay layers, and soft mud sheet remnant**

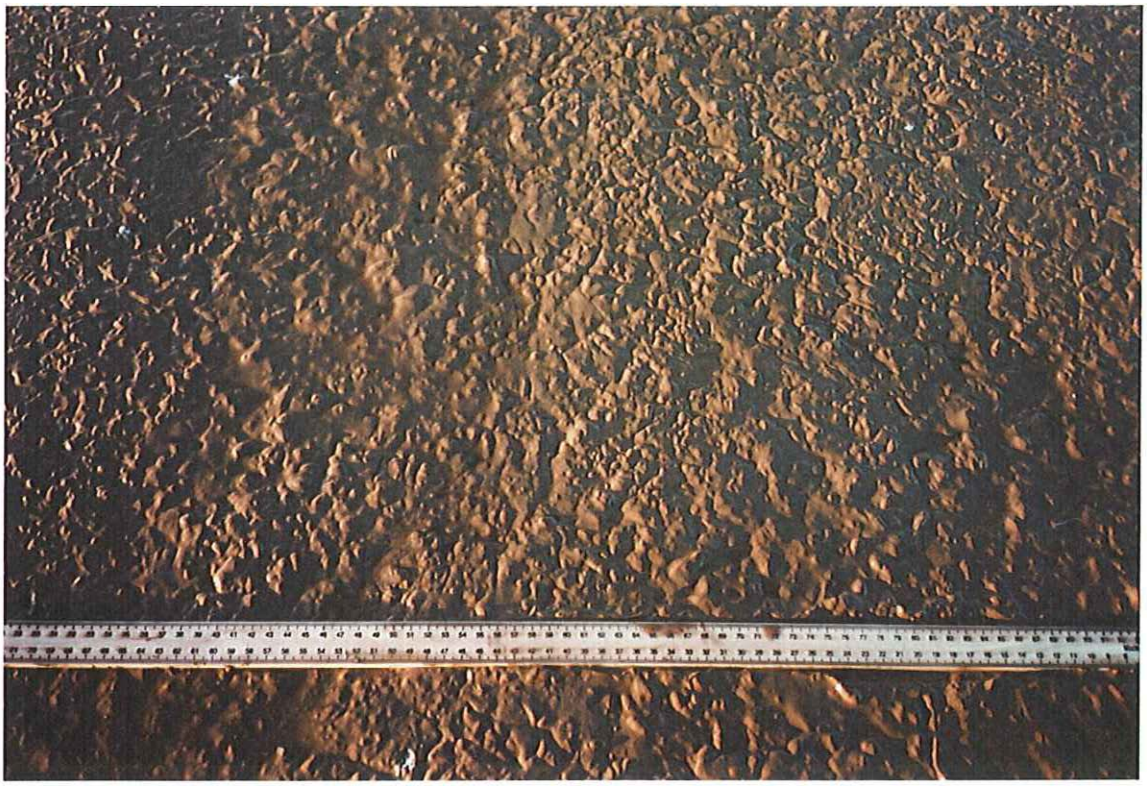


**Plate 7** **Surface features at station A in January 1998, showing scour erosion marks and bird footprint patterns in soft mud**

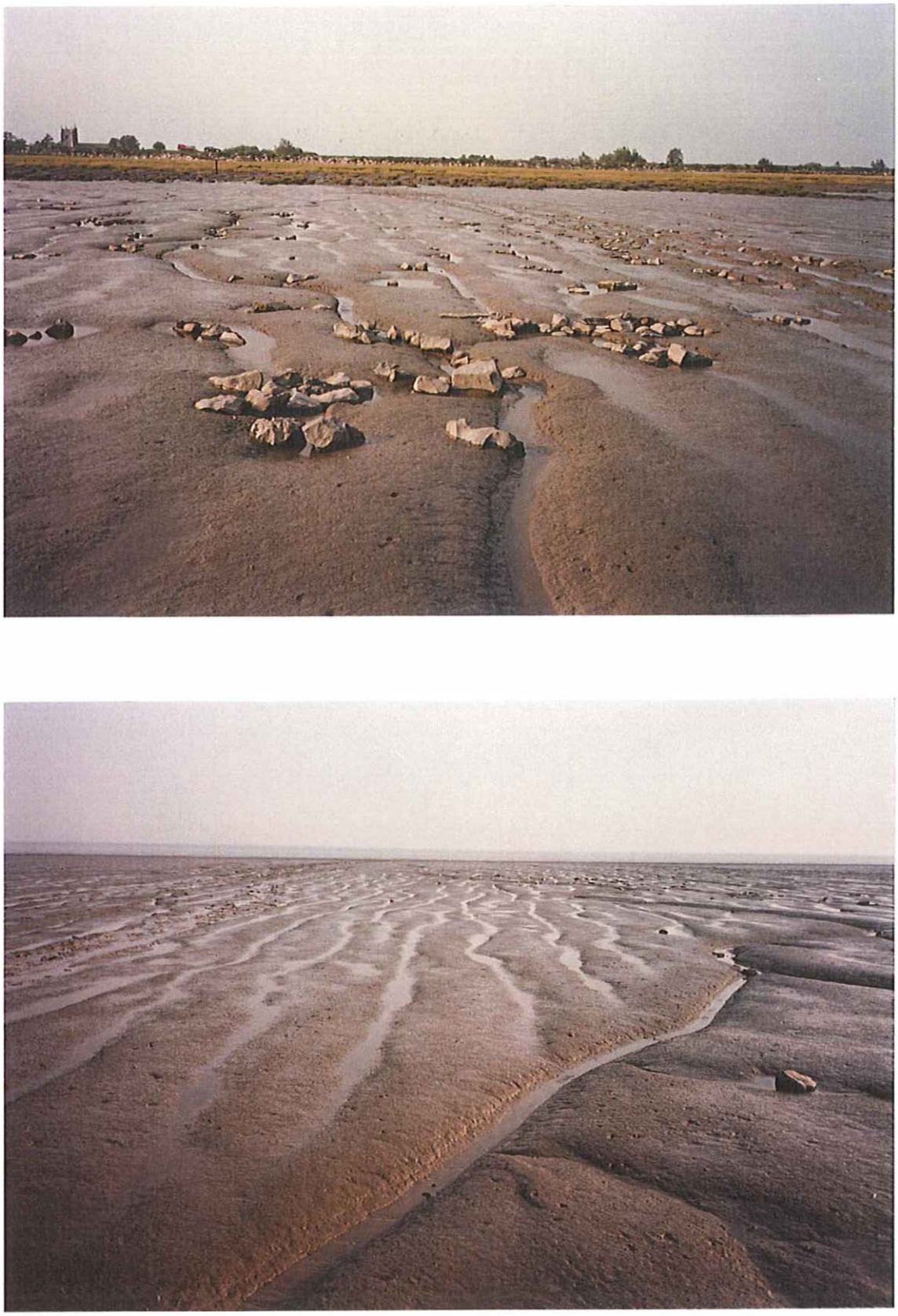


**Plate 8 Station A onshore and offshore view in September 1997**

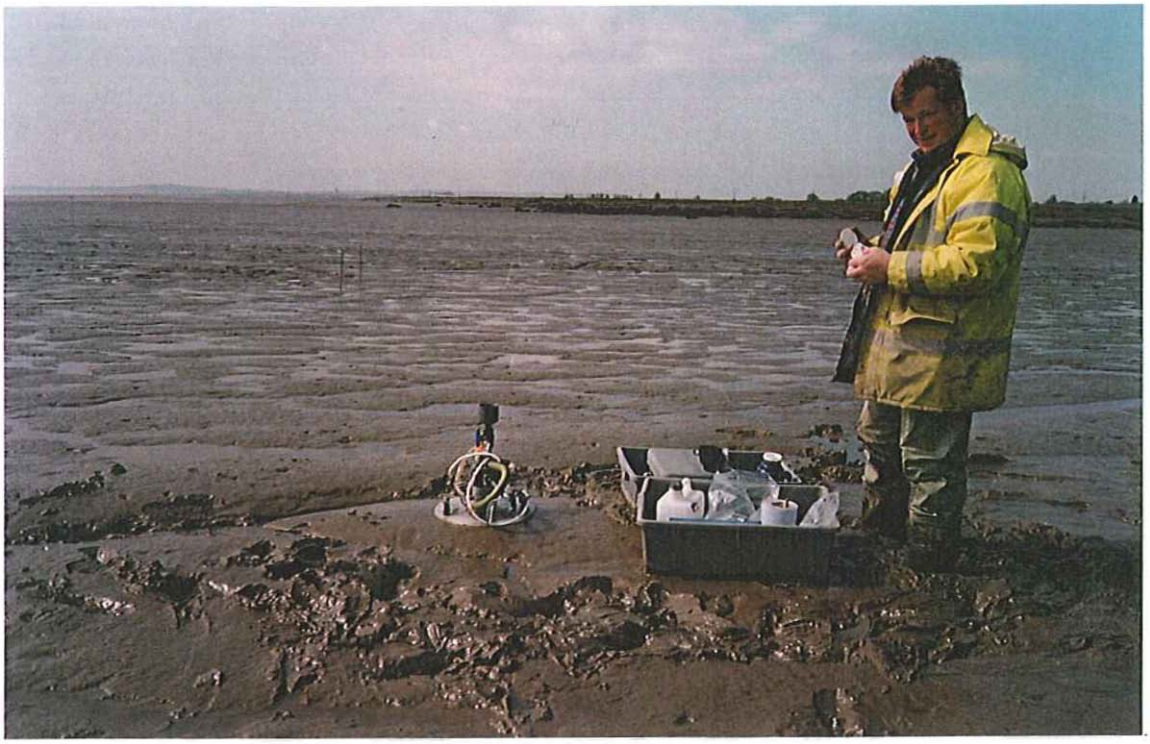


**Plate 9** **Station A surface features in April and September 1997**

**Plate 10 Station C surface features in June and September 1997**

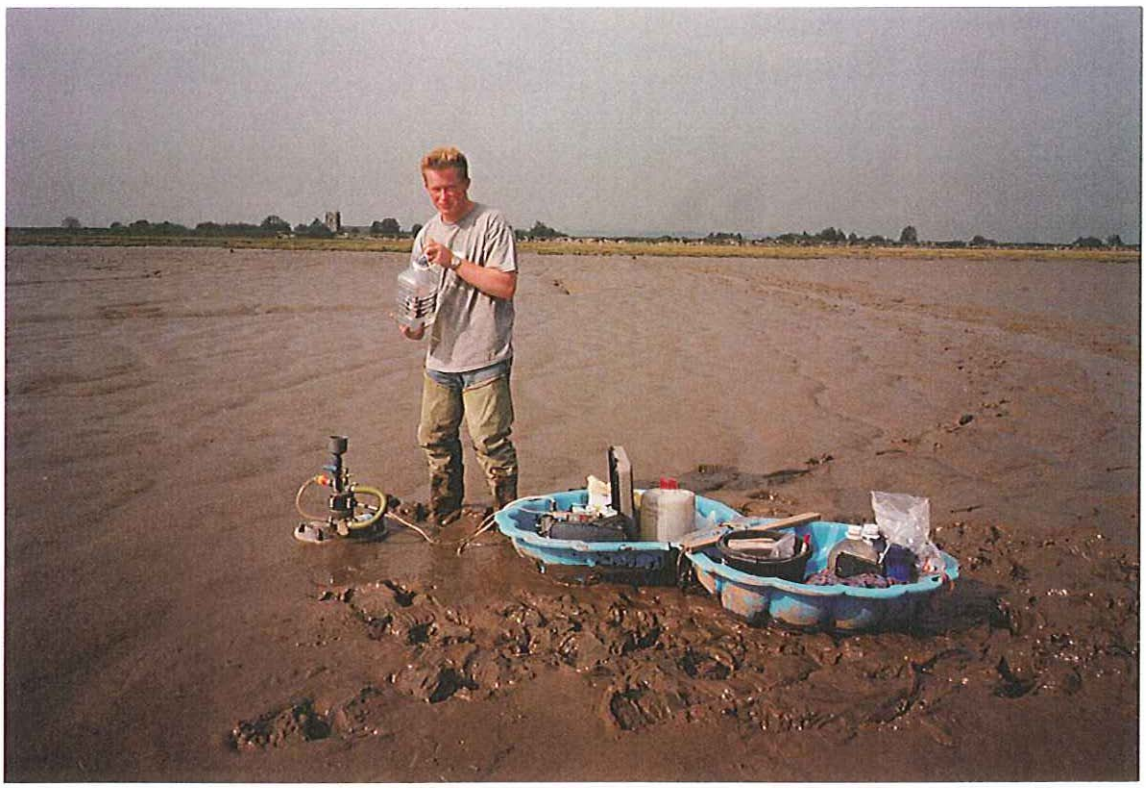


**Plate 11 Station C surface features in May and September 1997**

**Plate 12** **Station C/D surface features in May and June 1997**

# *Appendices*

# *Appendix 1*

Sediment analysis methods

## Appendix 1 Sediment Analysis Methods

### 1. Water Content - B.S. 1377 (1975)

1.1 Basic method

The samples were placed in pre-weighed dishes, weighed wet and then placed in an oven at 110°C for 24 hours. After this period the samples were allowed to cool in a dessicator and then weighed dry. The water content (wc) was then calculated using the following equation:

$$Water\ Content\ (wc) = \frac{M_w - M_d}{M_d} \quad (\%)$$

where:

$M_d$ = mass of dry sediment (g)
$M_w$ = mass of wet sediment (g)

1.2 Salinity Correction

As the samples contain salt water there must be a correction due to the salt weight in the interstitial water. The corrected sediment water content (wc') is calculated after Noornay (1984) as follows:

$$wc' = \frac{wc}{1 - r - r.wc}$$

where:

r = salinity of interstitial water (0.025)

### 2. Loss On Ignition

This method yields the % mass loss of the dry sediment when it is burnt to combust the components containing carbon within the sediment. It represents all of the carbon within the sediment which includes biologically derived organic material and inorganic material of a non-biogenic origin. It is a crude indicator of the biological activity of the sediment, but does include non-biological material as well, so care must be taken when interpreting the results.

The sediment samples were dried at 110°C for 24 hours to remove water and then ground using an agate pestle and mortar. Approximately 2g of sample is placed into a pre-weighed crucible and then ignited in a furnace for 4 hours at 450°C. The crucible and contents are then removed from the furnace and put into a vacuum dessicator to cool. The loss on ignition (LOI in %) is calculated as follows:

$$loss\ on\ ignition\ (LOI) = \frac{W1 - W2}{W1 - W0}.100\%$$

where:

LOI = loss on ignition (%)
W1 = mass of the crucible + sediment before ignition (g)
W2 = mass of the crucible + sediment after ignition (g)
W0 = mass of the crucible (g)

## 3. Grain size analysis

Samples were analysed for grain size using wet sieving at 90μm and a Micrometrics Sedigraph™ 5100 to produce the grain size distribution of the <90μm fraction. The pre-weighed dried samples was disaggreated in 0.1% Calgon solution for 24 hours before wet sieving. The >90μm was retained from the sieve and dried at 110°C for 24 hours, this allowed the <90μm fraction as a percentage of the total sample mass to be entered into the sedigraph. The <90μm fraction was dispersed for 2mins in an ultrasonic bath to reduce the effects of flocculation before being loaded into the sedigraph. One possible source of error when using the sedigraph™ is that its analysis is based on stokes law, which assumes that the particles are spherical whereas in reality the particles are far from spherical.

## 4. Colloidal Carbohydrate

1ml of distilled $H_2O$ was added to the sediment sample to extract the colloidal fraction. After mixing, the sample was stored at 20°C for 15 minutes. The samples were then centrifuged at 8000rpm for 10 minutes. 400μl of the supernatant was recovered and placed in a glass test tube to which 400μl of 5% aqueous phenol added. The solution was vortexed and 2ml of concentrated $H_2SO_4$ was added using a pump dispenser this resulted in an exothermic reaction. After 35 minutes at room temperature the solutions were transferred into semi-micro cuvettes and the sample absorbancies were read using a 'Cecil 300' scanning spectrophotometer at 486.5nm (Dubois *et al.*, 1956). Calibration was via a standard curve of absorption vs. glucose concentration to give results in microgram glucose equivalents. Further details of the method and its applications are found in Underwood *et al.* (1995).

## 5. References

DUBOIS, M., GILLES, K.A.. HAMILTON, J.K., REBER, P.A. and SMITH, F. 1956. Colorimetric method for determination of sugars and related substances. *Anal. Chem.* **28**: 350-356.

INTRMUD PROTOCOLS (1997). Guide document compiled for INTRMUD partners, by SERG (Severn Estuary Research Group), Gatty Marine Laboratory, St Andrews, Scotland, UK. February 1997.

NOORNAY, I. 1984 Phase relations in marine soils. *Journal of Geotechnical Engineering* Vol.110, No.4, pp.539-543.

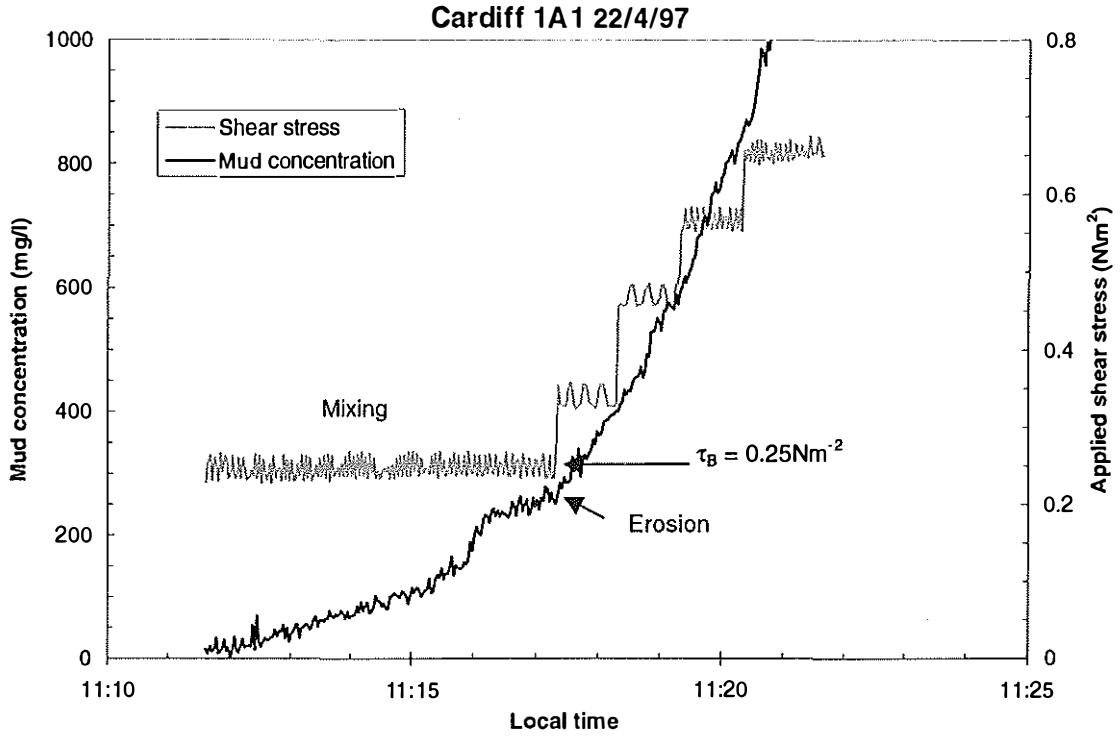
UNDERWOOD, G.J.C., PATERSON, D.M. AND PARKES, R.J. 1995. The measurement of microbial carbohydrate exopolymers from intertidal sediments. Limnol. Oceanogr. Vol.40 No.7, pp.1243-1253.

# *Appendix 2*

**SedErode Data Plots**

# SedErode Data Plots

## Cardiff April 1997




**Site:** **Cardiff seasonal survey April 1997**
Time: 11:12
Date: 22/04/96
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\capr001.l01

**Site description:**
texture: soft / medium
colour: medium red-brown
covering: surface water
topography: flat with Hydrobia
biologically activity: ragworms + Hydrobia
composition: mud / silt/ snails - homogeneous
other features: dewatering, sunny, calm

**Surface sample:** (from top 5mm) - DOB2

| | | |
|---|---|---|
| Water content: | 238 | % of dry weight |
| Bulk density: | 1235 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.65 | % by weight |
| Median size d50: | 3.09 | microns |
| Sand content: | 1.9 | % by weight |
| Silt content: | 57.5 | % by weight |
| Mud content: | 40.6 | % by weight |
| Mud Temperature: | 15.6 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.0
0.1
0.2
0.2
0.3
Average: 0.2

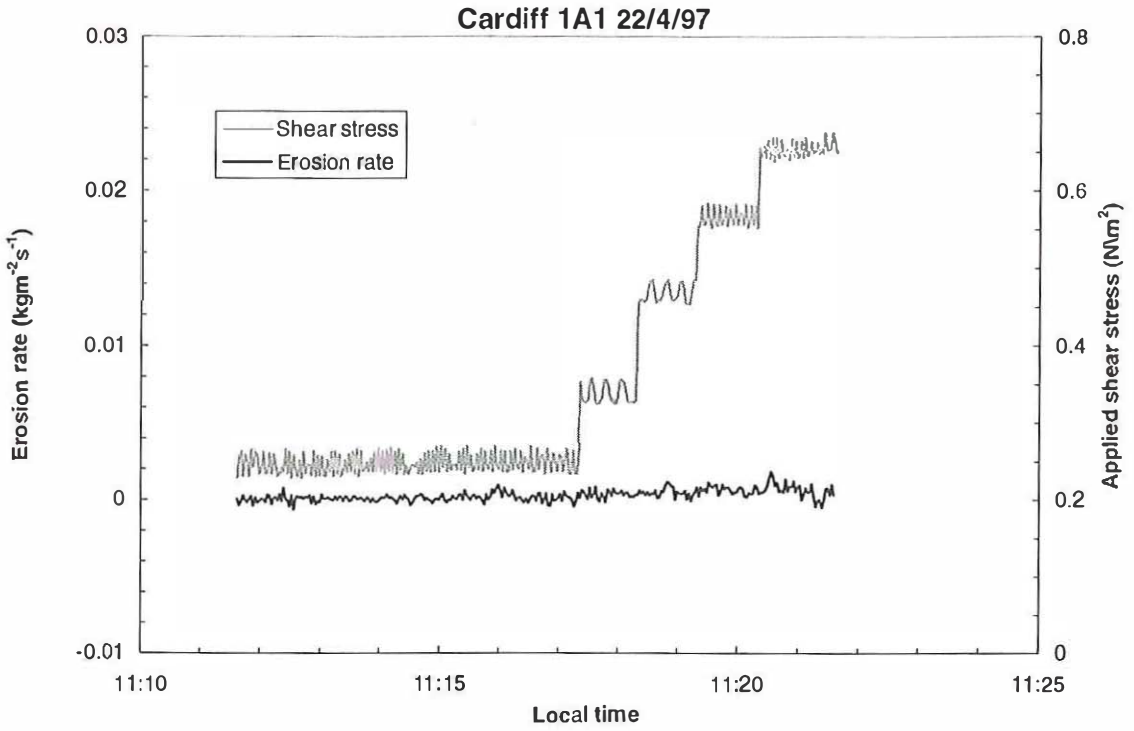
**Eroding Water:** (local collected at HW)
Salinity : 22.19

**Photographs:**
Time: 11:05
Film: 1
Number: 2

**Comments:**

**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

| | | |
|---|---|---|
| $\tau_A$ = | **0.00** | Nm$^{-2}$ |
| $\tau_B$ = | **0.25** | Nm$^{-2}$ |
| **Average =** | **0.13** | Nm$^{-2}$ |




**Site:** Cardiff seasonal survey April 1997
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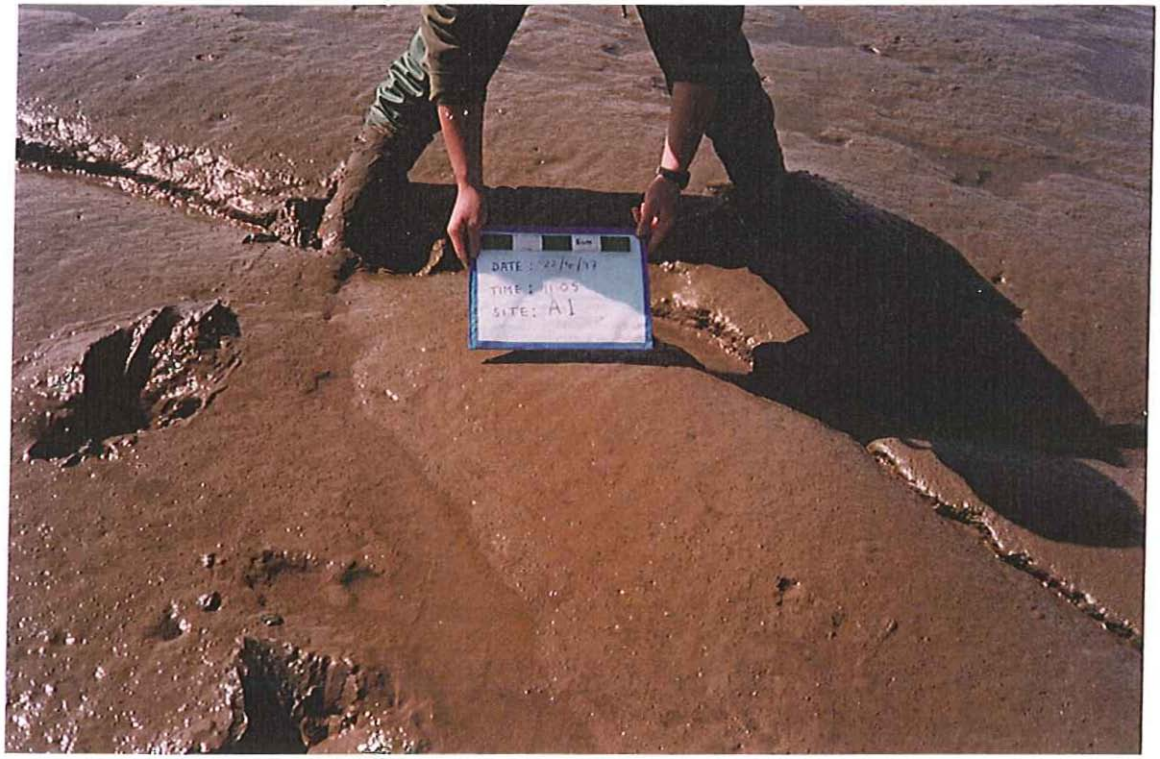
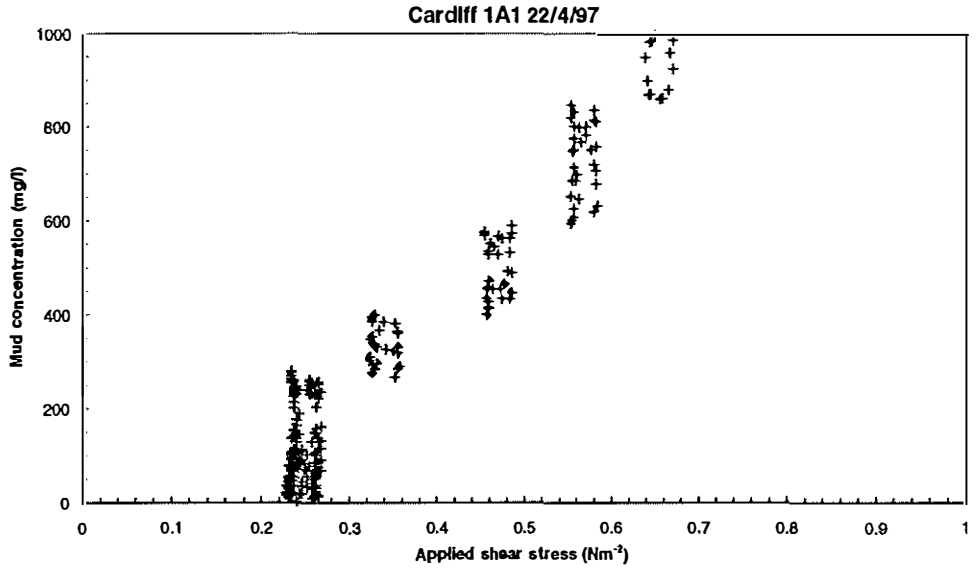
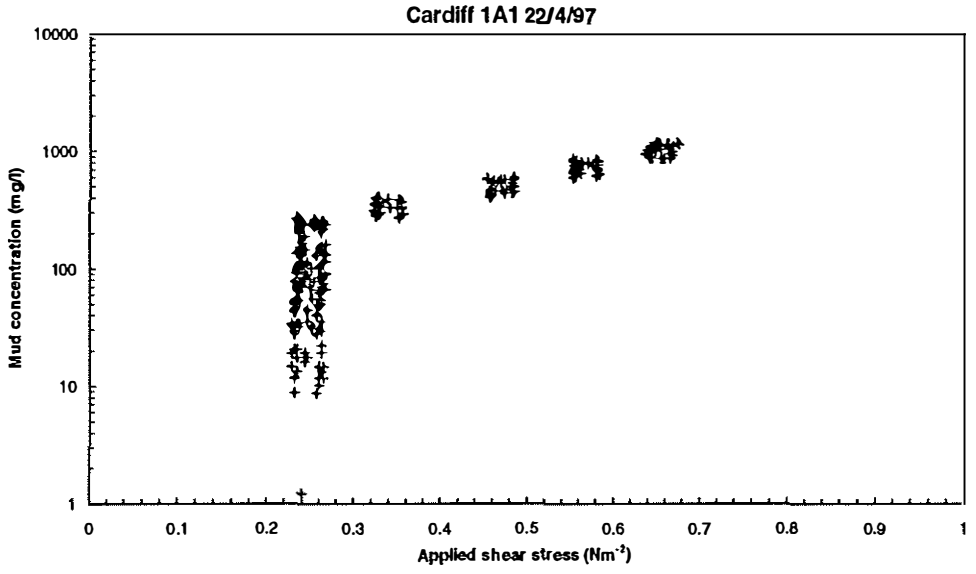
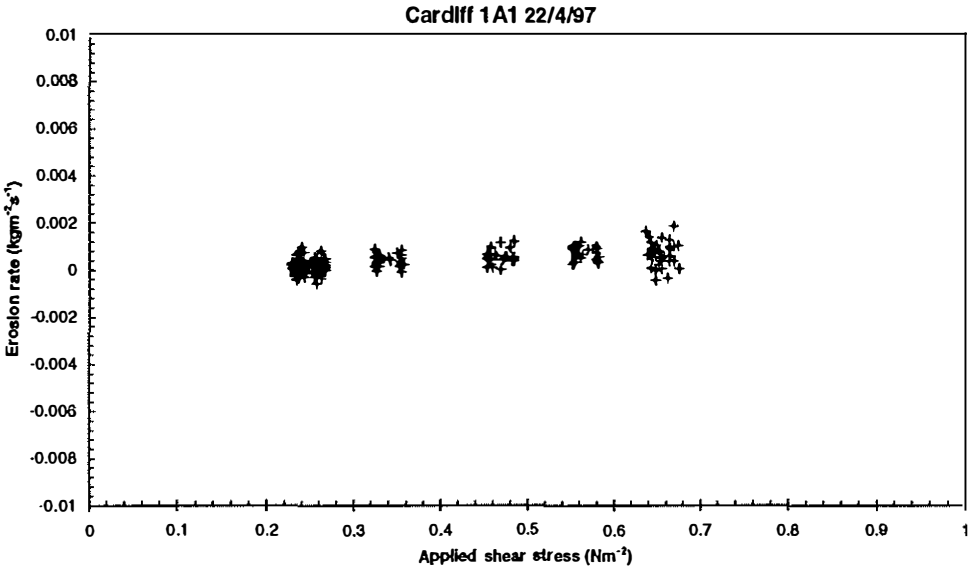
Date: 22/04/96
Operator: H.J.Mitchener

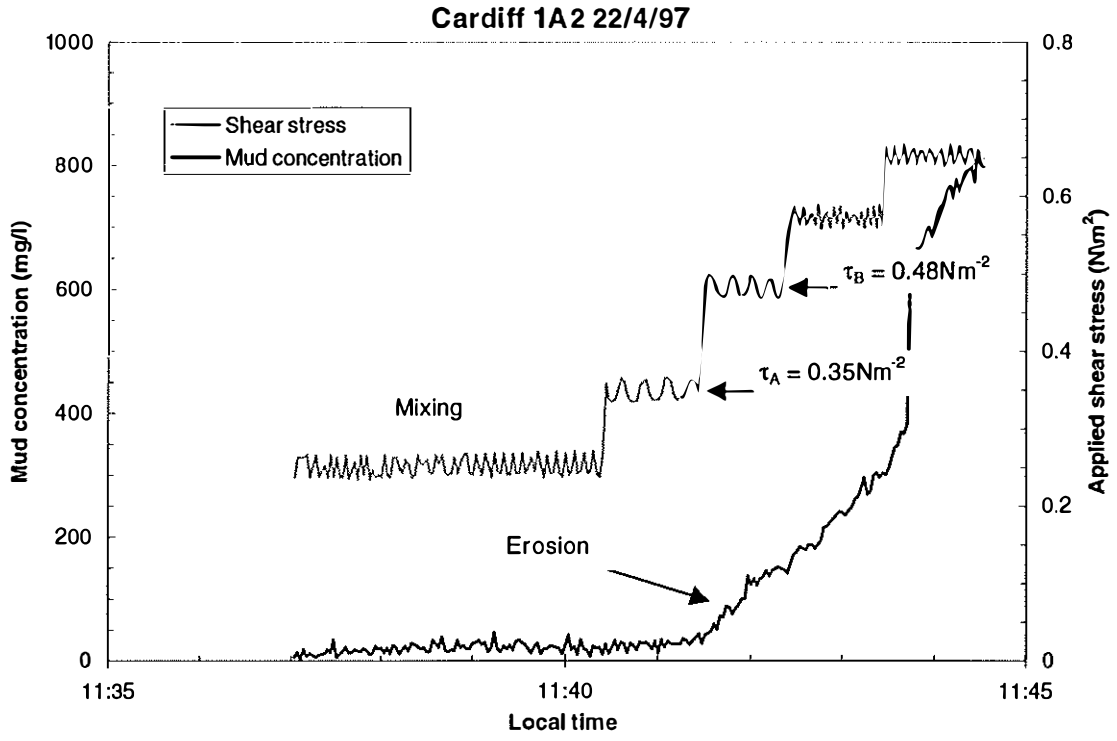
**Photographs:** Film: 1
Time: 11:05 Number: 2




Cardiff 1A1 22/4/97
Mud concentration (mg/l)
Applied shear stress (Nm-2)


Cardiff 1A1 22/4/97
Mud concentration (mg/l)
Applied shear stress (Nm-2)


Cardiff 1A1 22/4/97
Erosion rate (kgm-2s-1)
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey April 1997**
Time: **11**:28
Date: 22/04/96
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\capr002.l01

**Site description:**
texture: soft / medium
colour: medium red-brown
covering: surface water
topography: flat with Hydrobia
biologically activity: ragworms + Hydrobia
composition: mud / silt/ snails - homogeneous
other features: dewatering, sunny, calm near drainage channel

**Surface sample:** (from top 5mm) - DOB5

| | | |
|---|---|---|
| Water content: | 250 | % of dry weight |
| Bulk density: | 1227 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.83 | % by weight |
| Median size d50: | 2.68 | microns |
| Sand content: | 2.5 | % by weight |
| Silt content: | 52.9 | % by weight |
| Mud content: | 44.6 | % by weight |
| Mud Temperature: | 15.8 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.8
0.5
0.4
0.3
0.4
Average: 0.5

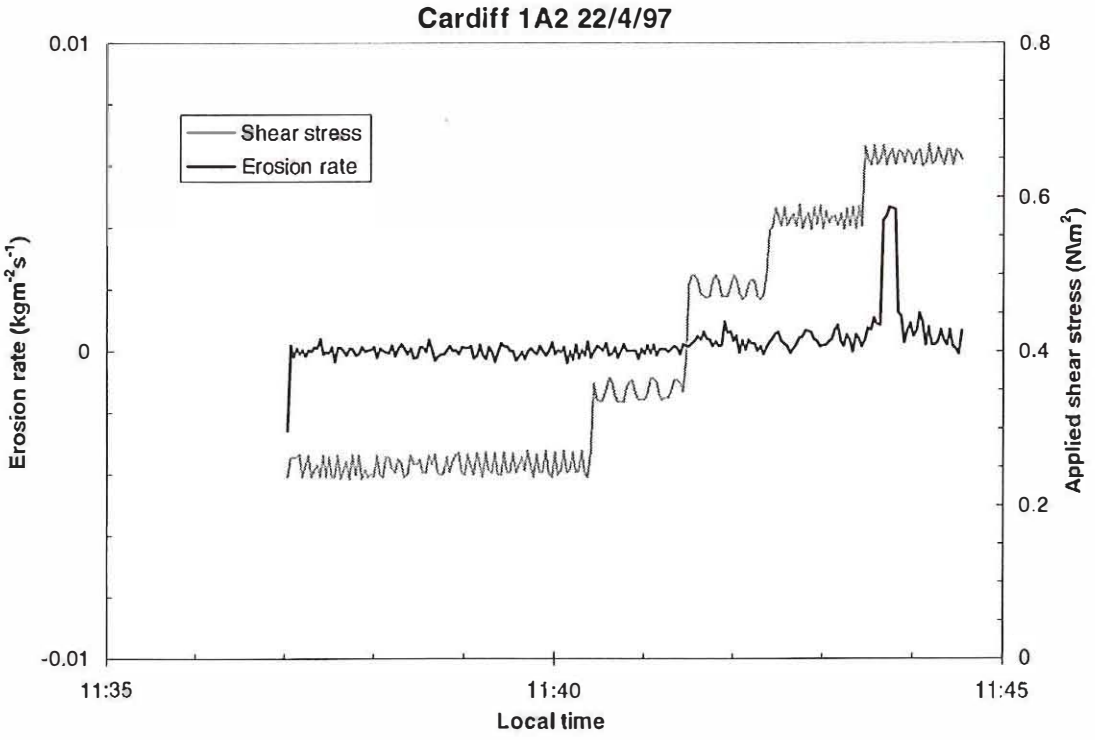
**Eroding Water:** (local collected at HW)
Salinity : 22.19

**Photographs:** Film: **1**
Time: **11**:27 Number: 3
Time: **11**:27 Number: 4

**Comments:**

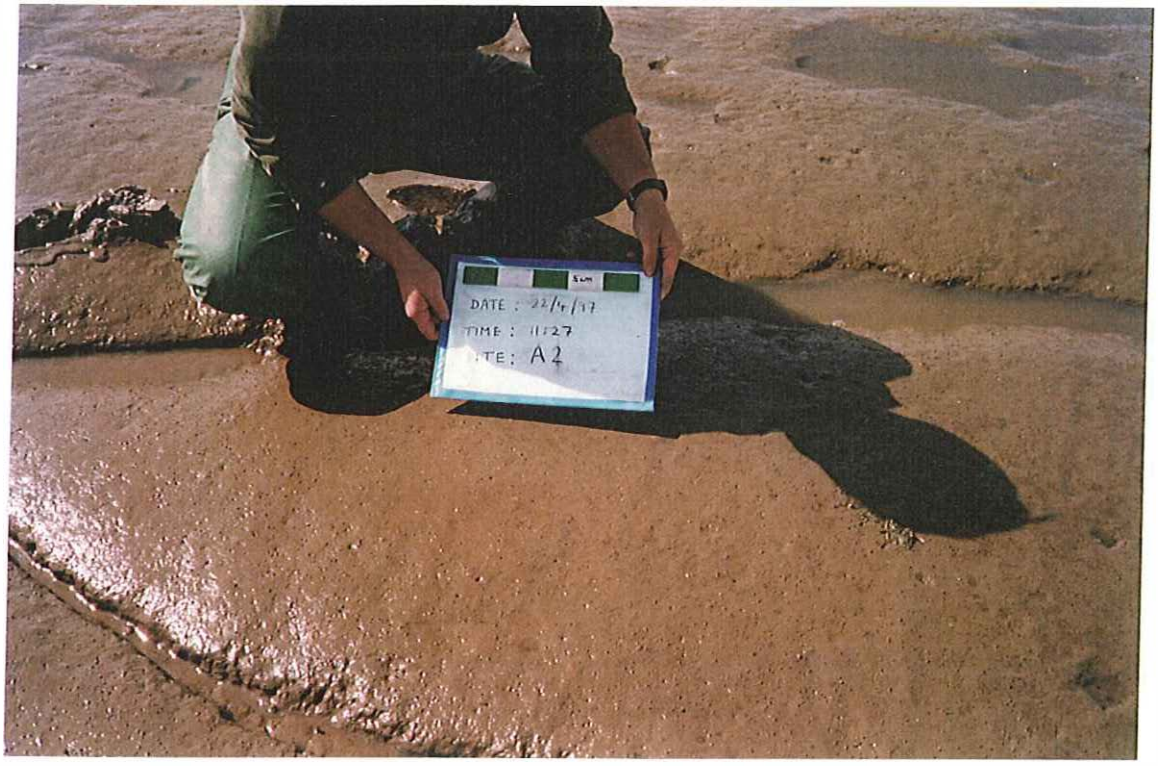
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

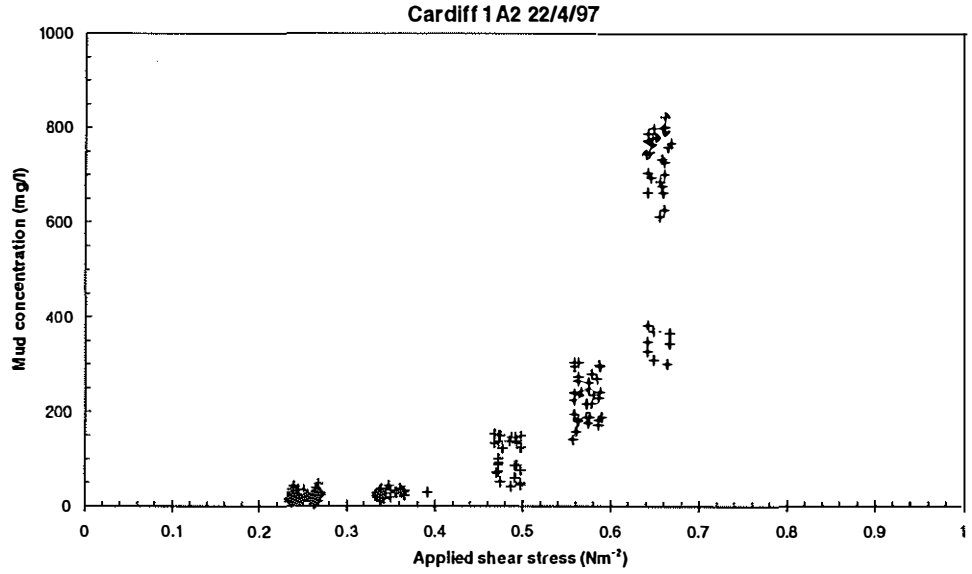
| | | |
|---|---|---|
| $\tau_A$ = | **0.35** | **Nm$^{-2}$** |
| $\tau_B$ = | **0.48** | **Nm$^{-2}$** |
| **Average** | **0.42** | **Nm$^{-2}$** |

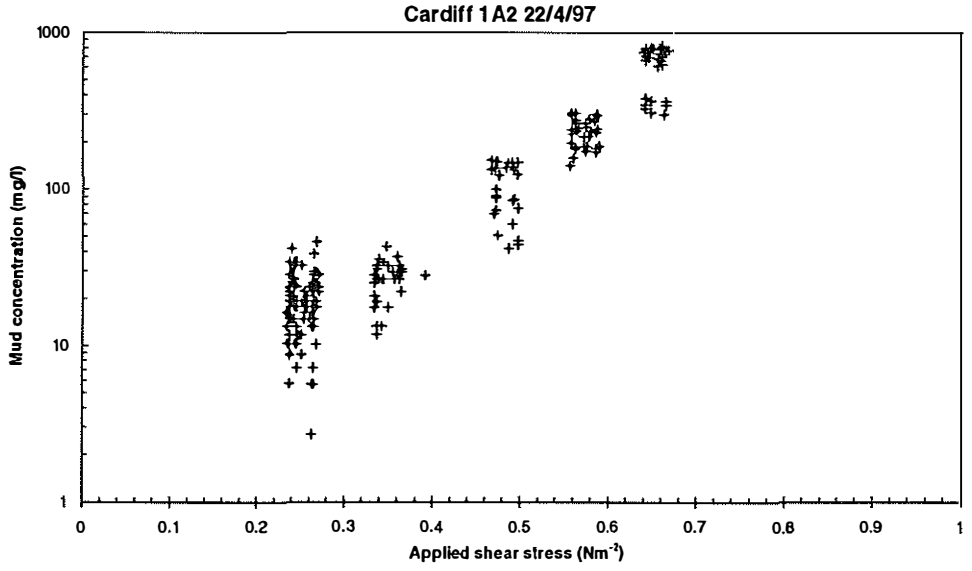


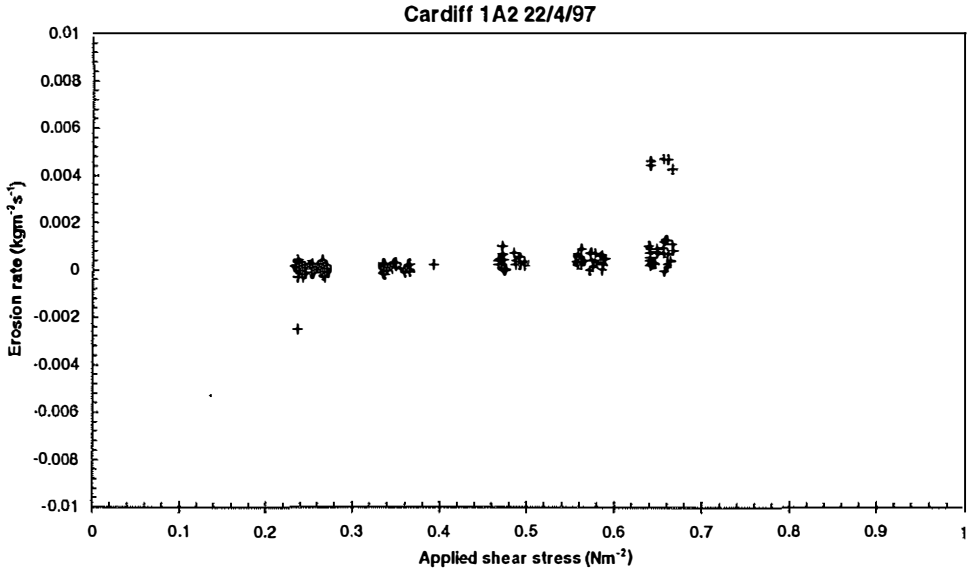

**Site:** **Cardiff seasonal survey April 1997**
Time: 11:28
Date: 22/04/96
Operator: H.J.Mitchener

**Photographs:** Film 1
Time: 11:27 Number: 3
Time: 11:27 Number: 4

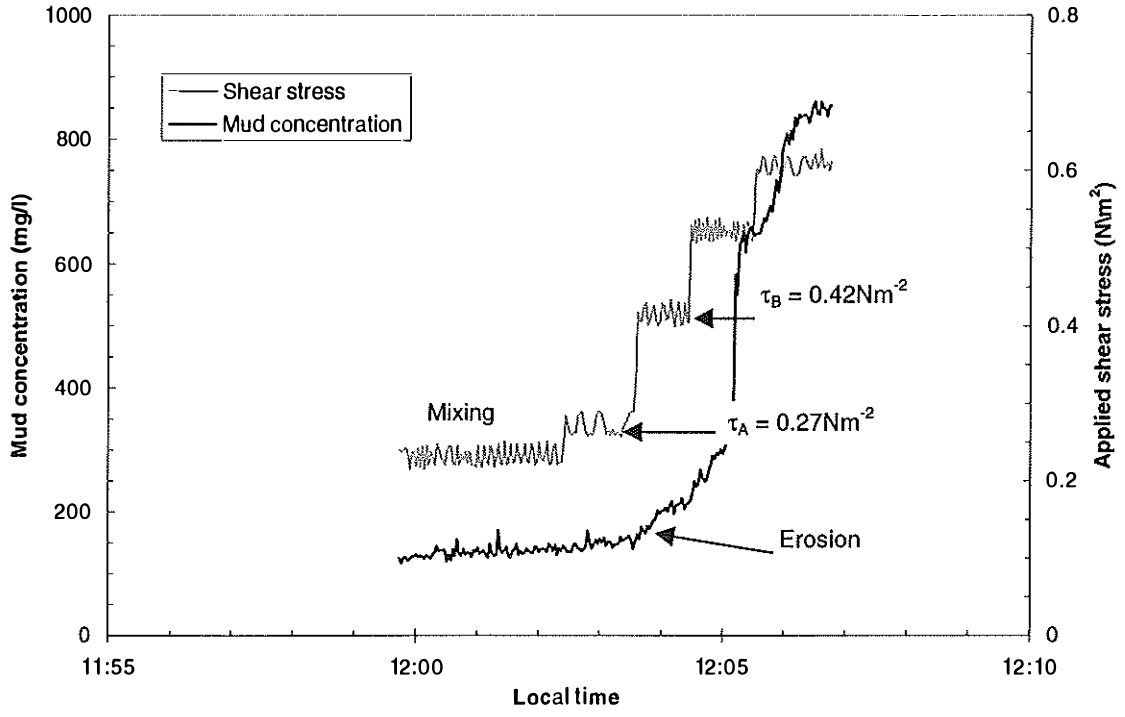



Cardiff 1A2 22/4/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 1A2 22/4/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 1A2 22/4/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)

## Cardiff 1A3 22/4/97




**Site:** **Cardiff seasonal survey April 1997**
Time: 11:50
Date: 22/04/96
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\capr003.l01

**Site description:**
texture: soft / medium
colour: medium red-brown
covering: Hydrobia snails!
topography: flat under snails
biologically activity: ragworms + Hydrobia
composition: clay/ silt/ snails - homogeneous
other features: hardening under sunny dry conditions

**Surface sample:** (from top 5mm) - DOB8

| | | |
|---|---|---|
| Water content: | 205 | % of dry weight |
| Bulk density: | 1264 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.95 | % by weight |
| Median size d50: | 3.09 | microns |
| Sand content: | 3.4 | % by weight |
| Silt content: | 54.8 | % by weight |
| Mud content: | 41.8 | % by weight |
| Mud Temperature: | 18.8 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.9
0.8
0.8
0.8
0.8
Average: 0.8

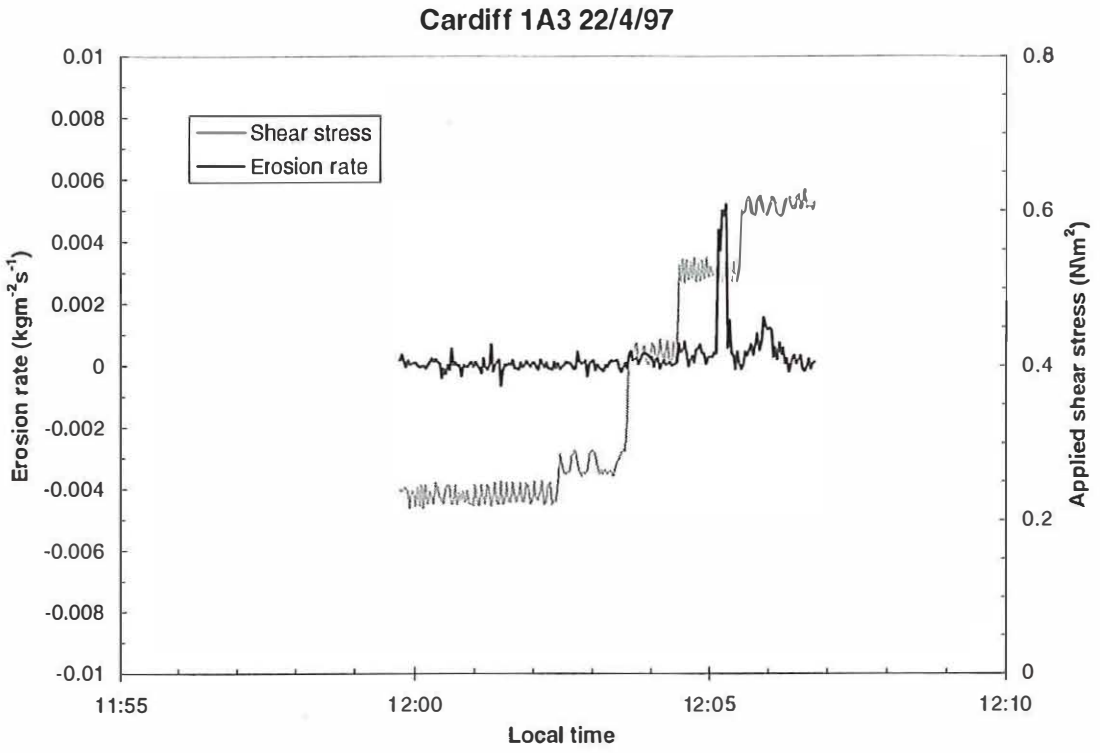
**Eroding Water:** (local collected at HW)
Salinity : 22.19

**Photographs:**
Film: 1
Time: 11:50 Number: 5

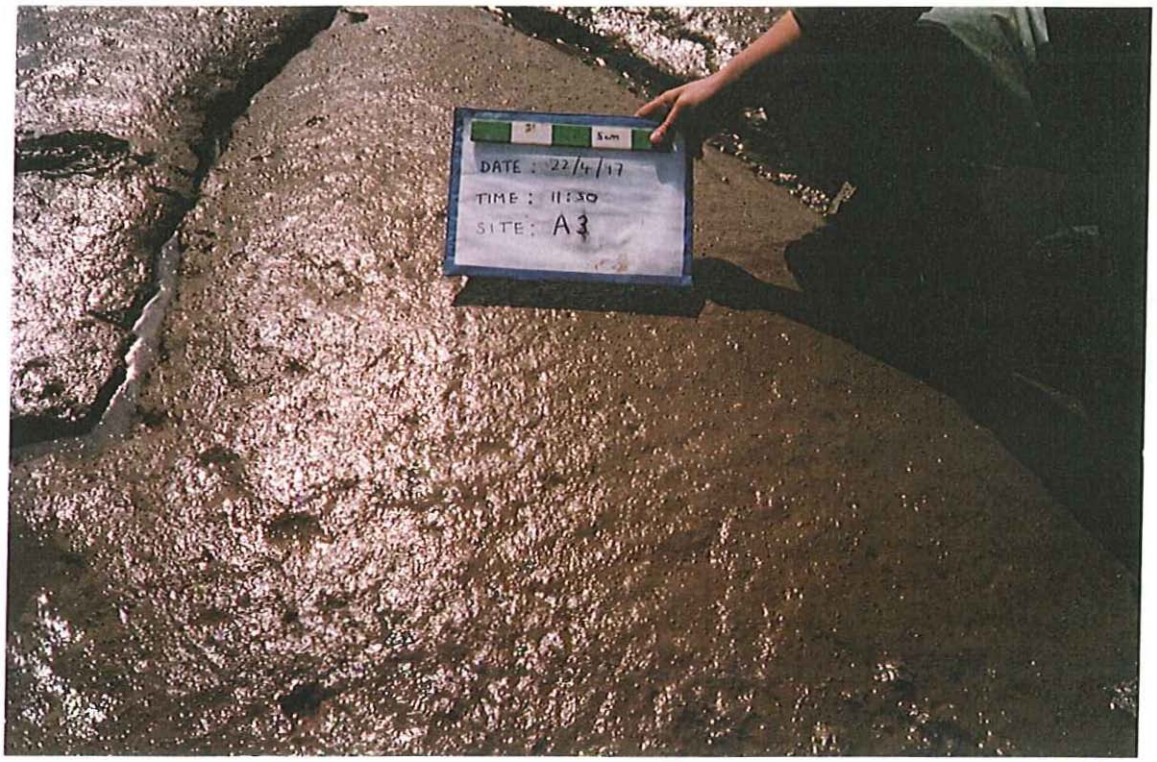
**Comments:**

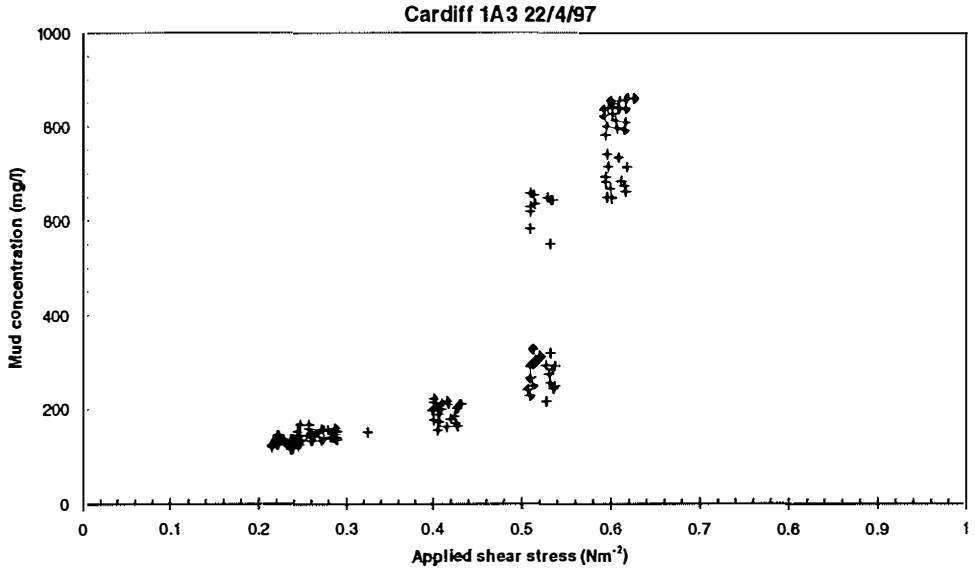
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

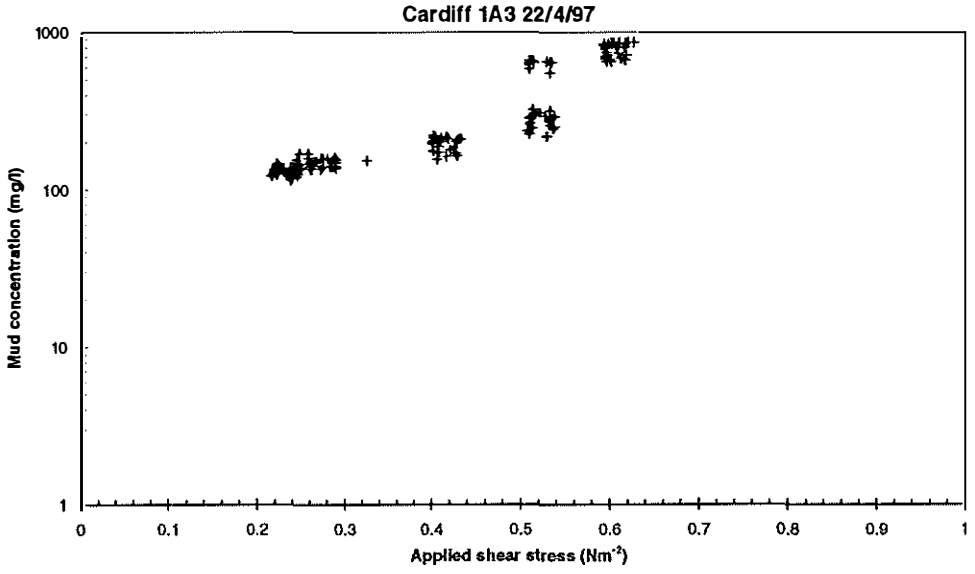
| | | |
|---|---|---|
| $\tau_A$ = | 0.27 | Nm$^{-2}$ |
| $\tau_B$ = | 0.42 | Nm$^{-2}$ |
| Average = | 0.34 | Nm$^{-2}$ |

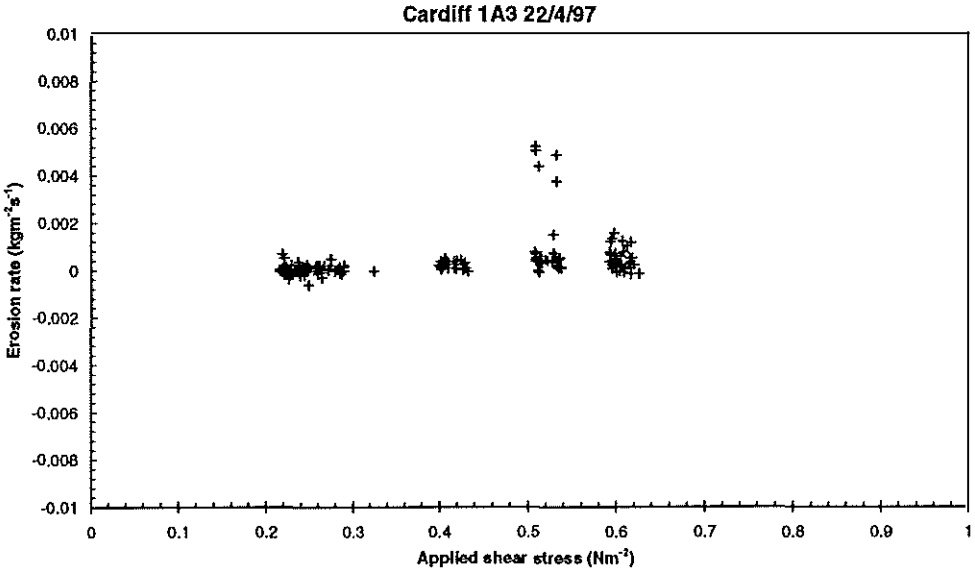


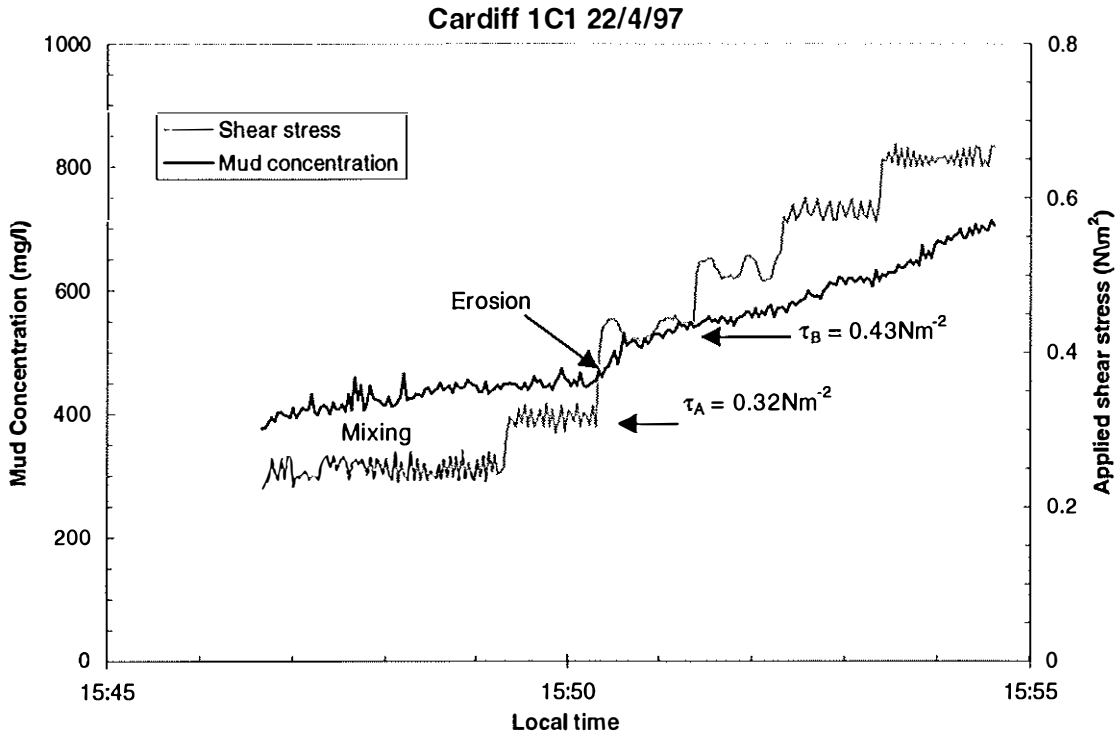

**Site:** Cardiff seasonal survey Aprll 1997 **Photographs:** Film: 1
Time: 11:50 Time: 11:50 Number: 5
Date: 22/04/96
Operator: H.J.Mitchener




Cardiff 1A3 22/4/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Cardiff 1A3 22/4/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Cardiff 1A3 22/4/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey April 1997**
Time: 15:47
Date: 22/04/96
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\capr010.l01

**Site description:**
texture: medium /soft
colour: medium red/brown
covering: Hydrobia snails
topography: flat uner snails
biologically activity: ragworms and Hydrobia
composition: clay/silt/snails - homogeneous
other features: worm holes - 2nd attempt
cloudy dull raining

**Surface sample:** (from top 5mm) - DOB23

| | | |
|---|---|---|
| Water content: | 231 | % of dry weight |
| Bulk density: | 1241 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.98 | % by weight |
| Median size d50: | 2.11 | microns |
| Sand content: | 2.8 | % by weight |
| Silt content: | 48.3 | % by weight |
| Mud content: | 48.9 | % by weight |
| Mud Temperature: | 16.7 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.1
0.1
0.1
0.2
0.2
Average: 0.1

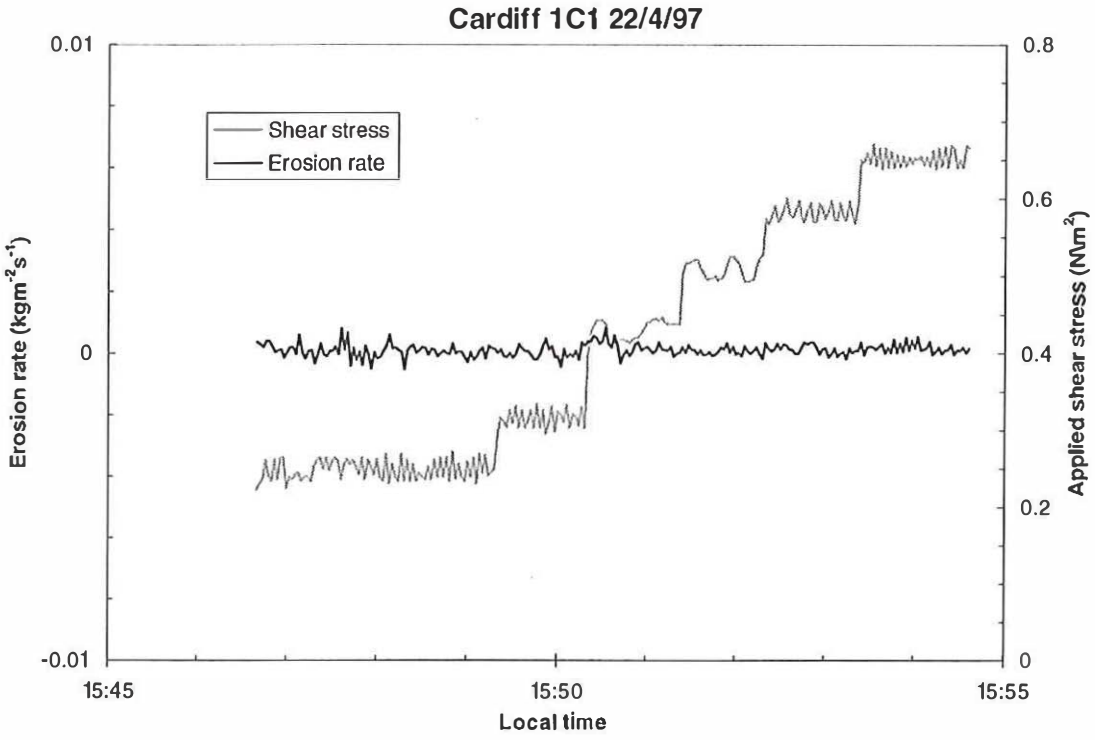
**Eroding Water:** (local collected at HW)
Salinity : 22.19

**Photographs:**
Film : 1
Time: 15:35 Number: 14

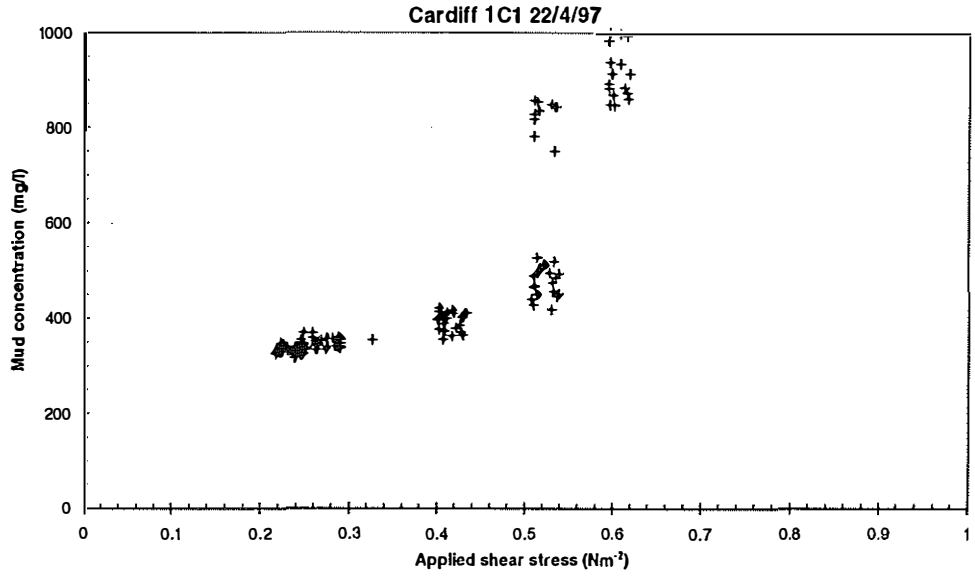
**Comments:**

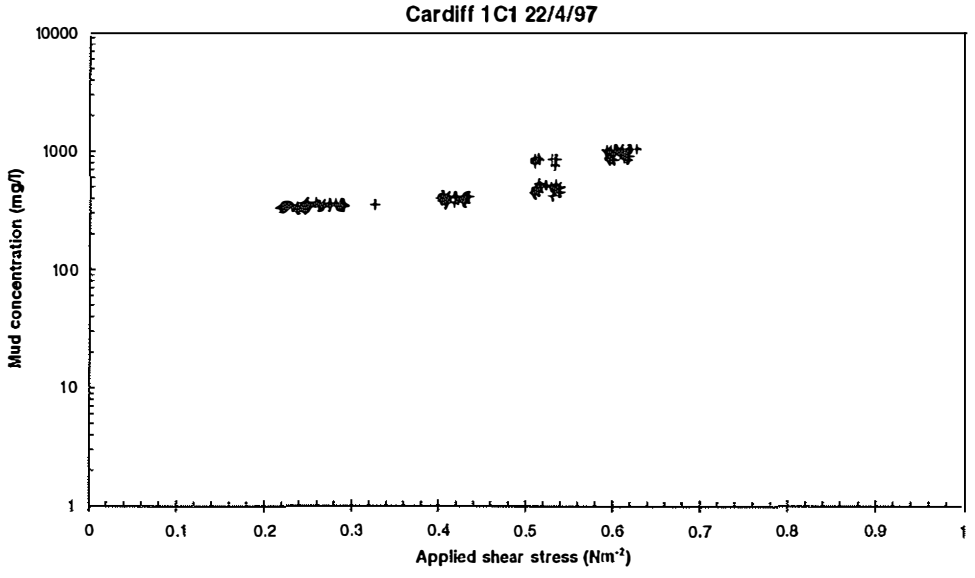
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

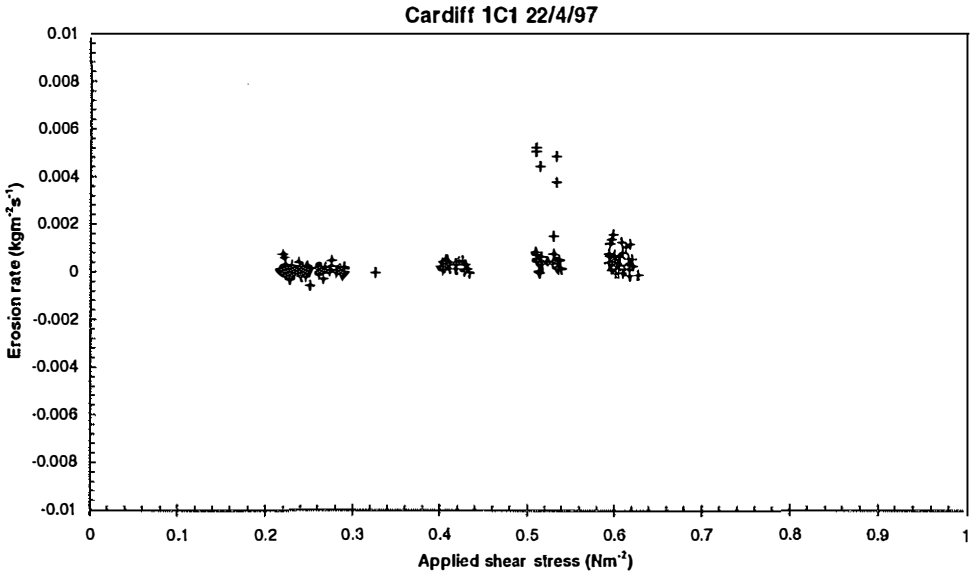
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.32** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.43** | **Nm$^{-2}$** |
| **Average =** | **0.37** | **Nm$^{-2}$** |

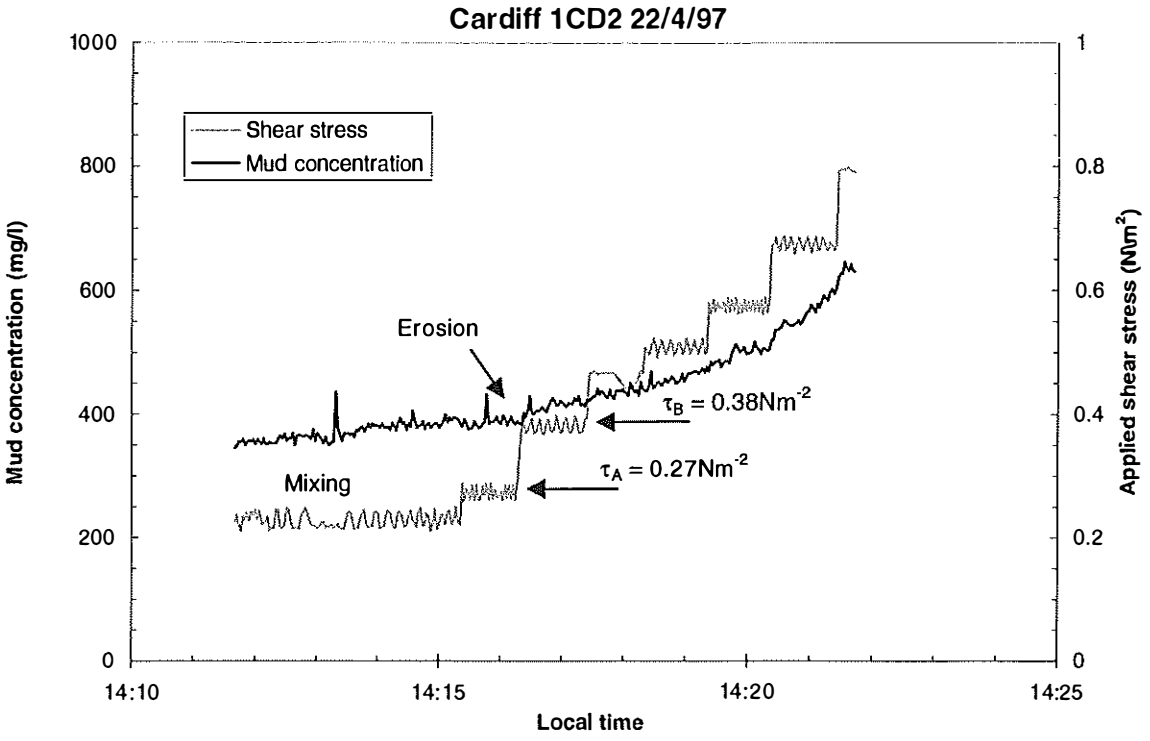



| | | | | | |
|---|---|---|---|---|---|
| **Site:** | **Cardiff seasonal survey April 1997** | **Photographs:** | | Film: | 1 |
| Time: | 15:47 | Time: | 15:35 | Number: | 14 |
| Date: | 22/04/96 | | | | |
| Operator: | H.J.Mitchener | | | | |


Cardiff 1C1 22/4/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 1C1 22/4/97
Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 1C1 22/4/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey April 1997**
Time: 14:07
Date: 22/04/96
Operator: H.J.Mitchener

Data **file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\capr007.l01

**Site description:**
texture: soft/medium
colour: medium red/brown
covering: Hydrobia snails
topography: flat under snails
biologically activity: ragworms + Hydrobia
composition: clay/silt/ snails - homogeneous
other features: hardening in sunshine, calm

**Surface sample:** (from top 5mm) - DOB 14

| | | |
|---|---|---|
| Water content: | 212 | % of dry weight |
| Bulk density: | 1258 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.39 | % by weight |
| Median size d50: | 2.33 | microns |
| Sand content: | 5.8 | % by weight |
| Silt content: | 47.2 | % by weight |
| Mud content: | 47.0 | % by weight |
| Mud Temperature: | 22 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.9
0.7
0.5
0.4
0.8
Average: 0.7

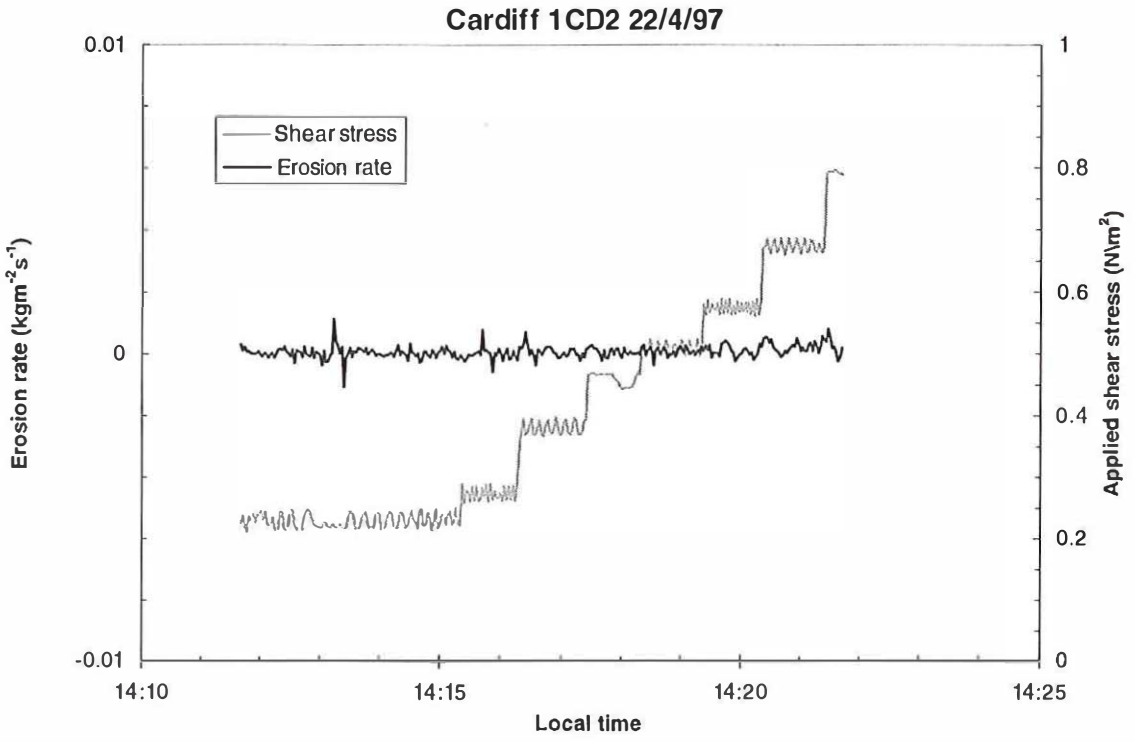
**Eroding Water:** (local collected at HW)
Salinity : 22.19

**Photographs:** Film : 1
Time: 14:07 Number: 10

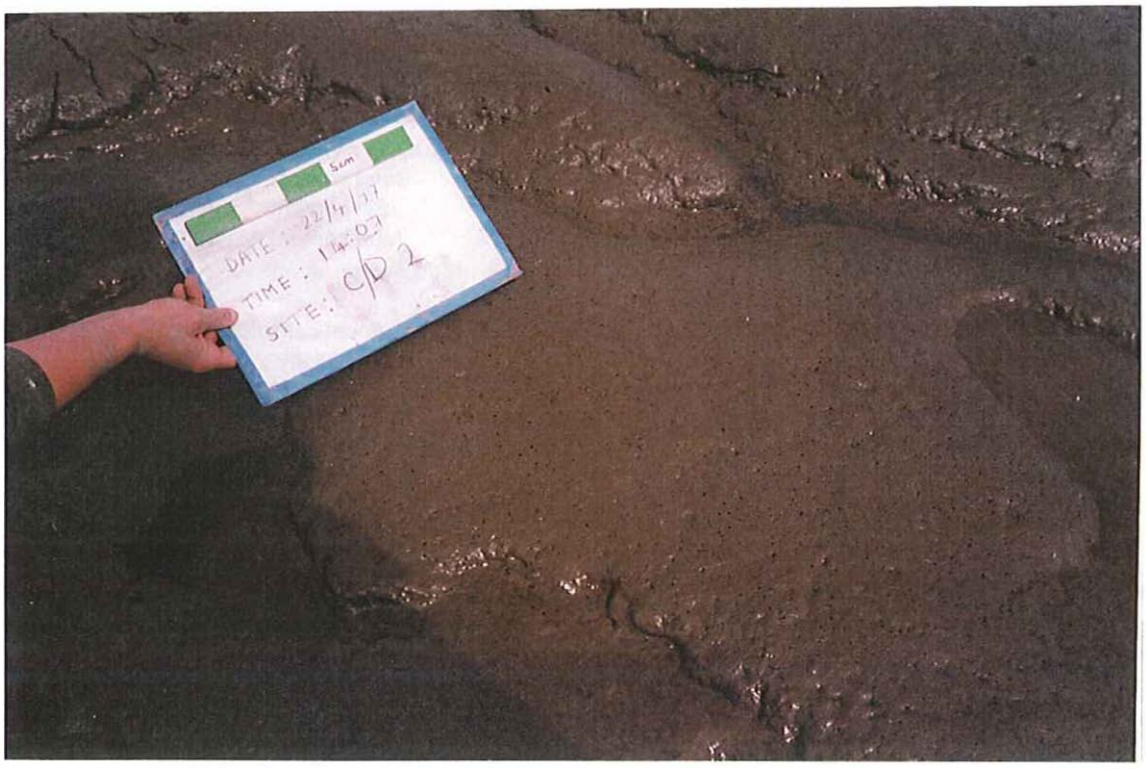
**Comments:**

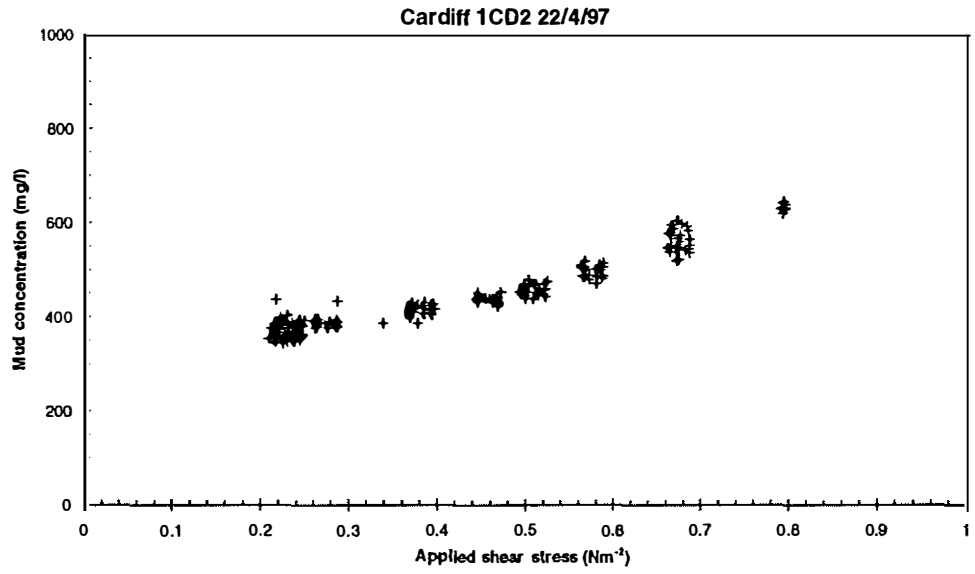
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

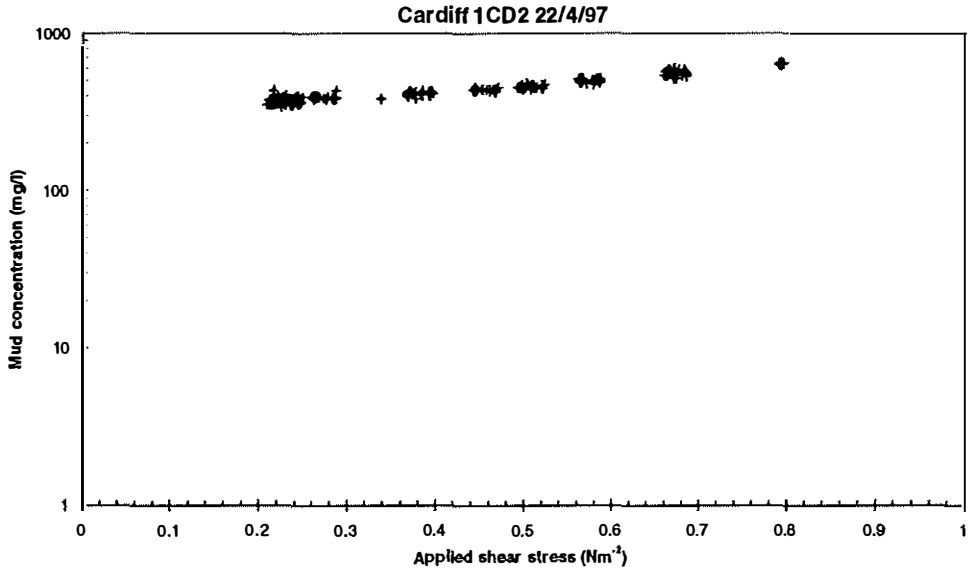
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.27** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.38** | **Nm$^{-2}$** |
| **Average =** | **0.33** | **Nm$^{-2}$** |

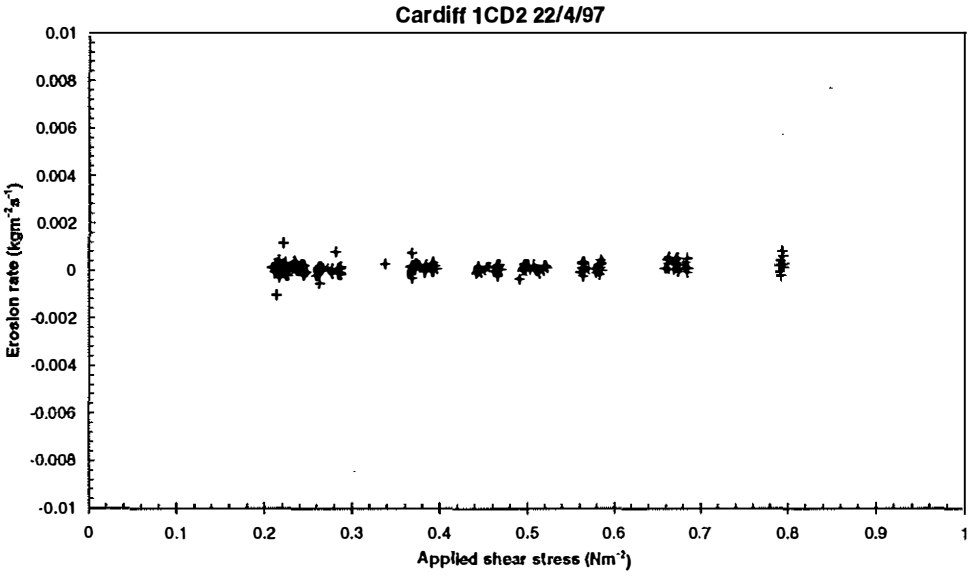


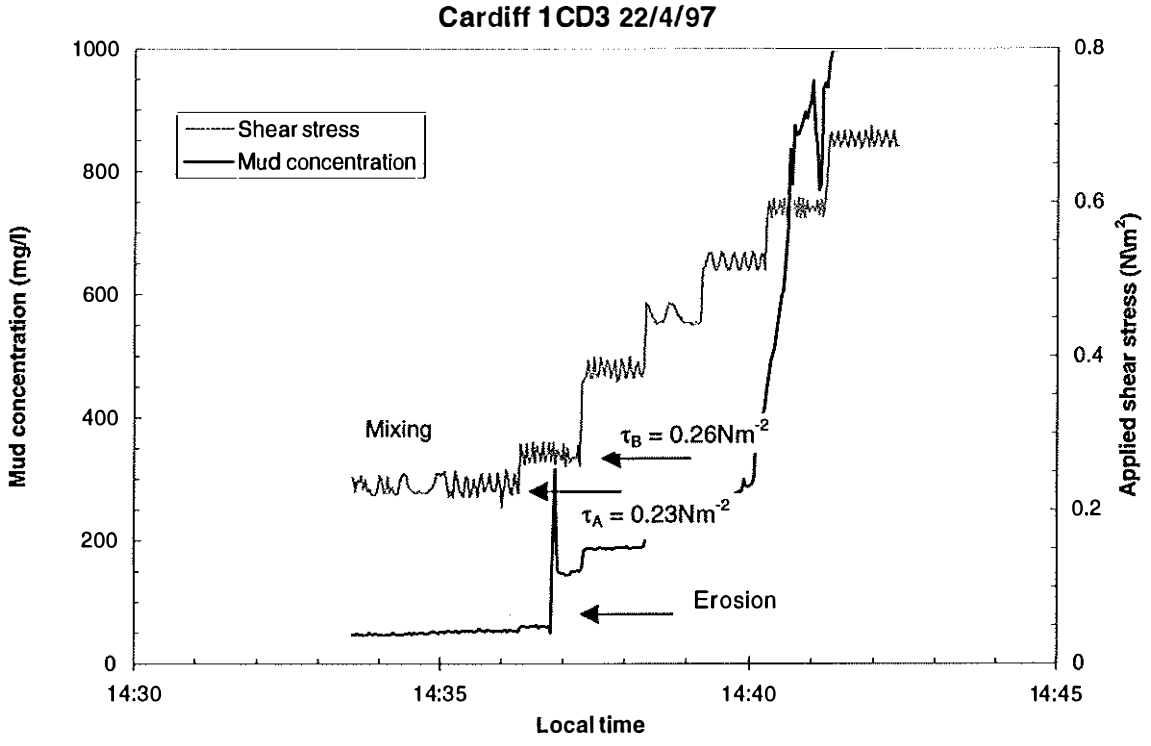

| | | | | | |
|---|---|---|---|---|---|
| **Site:** | **Cardiff seasonal survey April 1997** | **Photographs:** | | Film: | 1 |
| Time: | 14:07 | | Time: 14:07 | Number: | 10 |
| Date: | 22/04/96 | | | | |
| Operator: | H.J.Mitchener | | | | |




Cardiff 1CD2 22/4/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 1CD2 22/4/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 1CD2 22/4/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey April 1997**
Time: 14:25
Date: 22/04/96
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\capr007.l01

CHANGED FILLING PROCEDURE

**Site description:**
texture: soft/medium
colour: medium red/brown
covering: scant Hydrobia, worm holes
topography: flat under snails
biologically activity: ragworms + Hydrobia
composition: clay /silt/ snails - homogeneous
other features: hardening in sunshine, calm drained, many wormholes

**Surface sample:** (from top 5mm) - DOB17

| | | |
|---|---|---|
| Water content: | 217 | % of dry weight |
| Bulk density: | 1253 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.55 | % by weight |
| Median size d50: | 2.22 | microns |
| Sand content: | 3.4 | % by weight |
| Silt content: | 48.7 | % by weight |
| Mud content: | 47.9 | % by weight |
| Mud Temperature: | 22.1 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.3
0.0
0.3
0.2
0.1
Average: 0.2

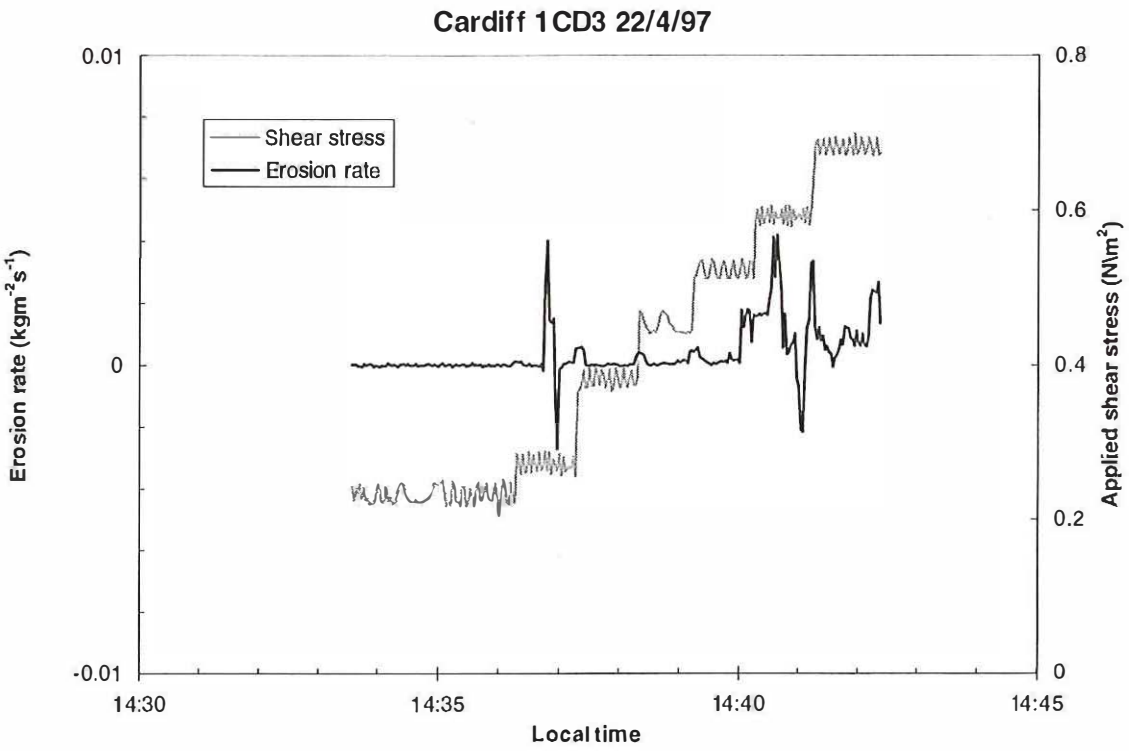
**Eroding Water:** (local collected at HW)
Salinity : 22.19

**Photographs:** Film : 1
Time: 14:27 Number: 11

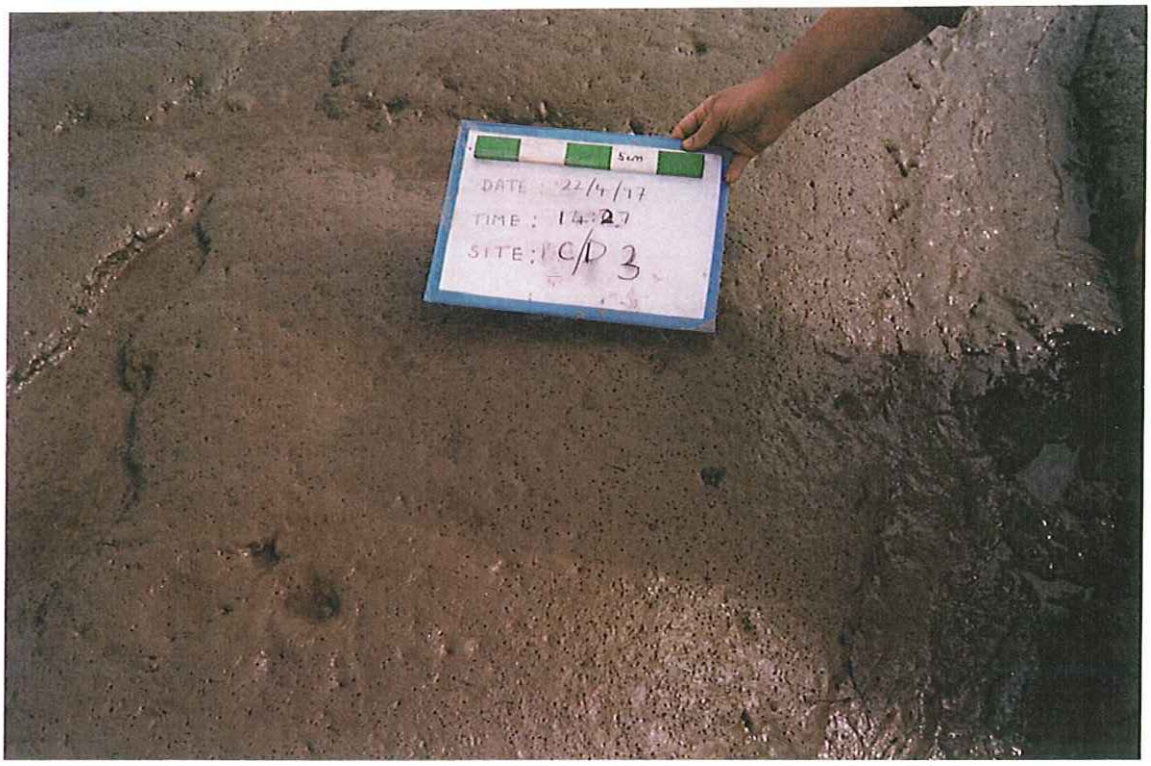
**Comments:**

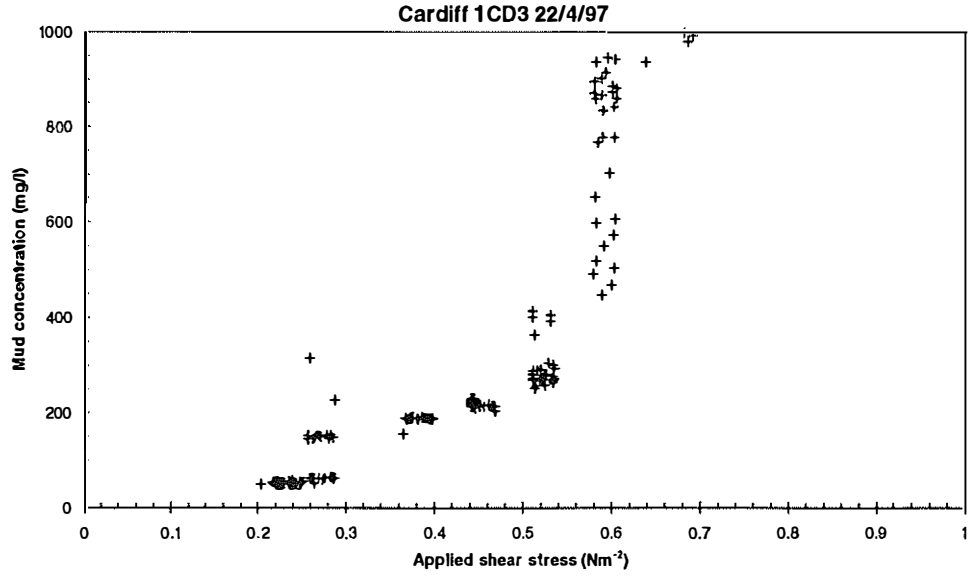
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

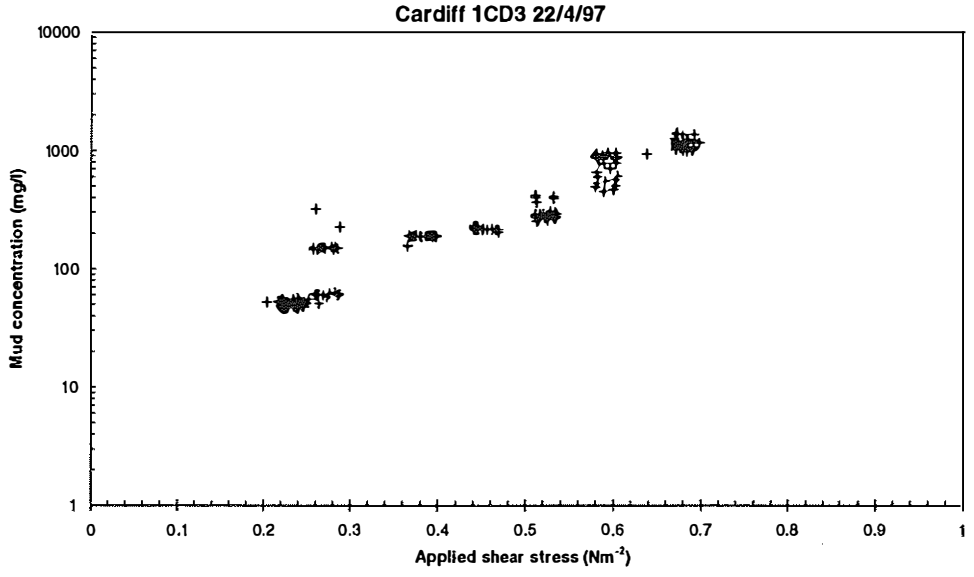
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.23** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.26** | **Nm$^{-2}$** |
| **Average** | **0.24** | **Nm$^{-2}$** |

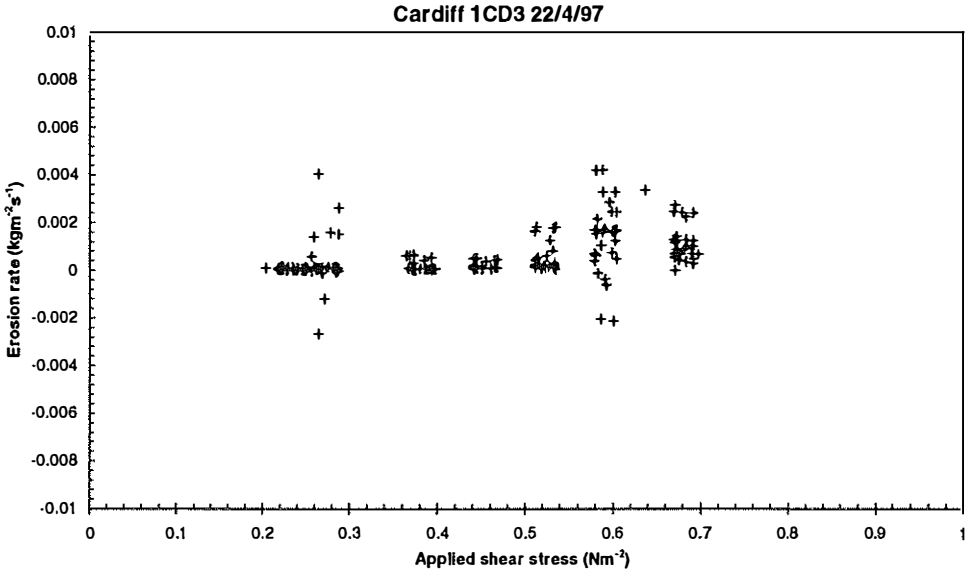



**Site:** **Cardiff seasonal survey April 1997** **Photographs:** Film: **1**
Time: 14:25 Time: 14:27 Number: **11**
Date: 22/04/96
Operator: H.J.Mitchener



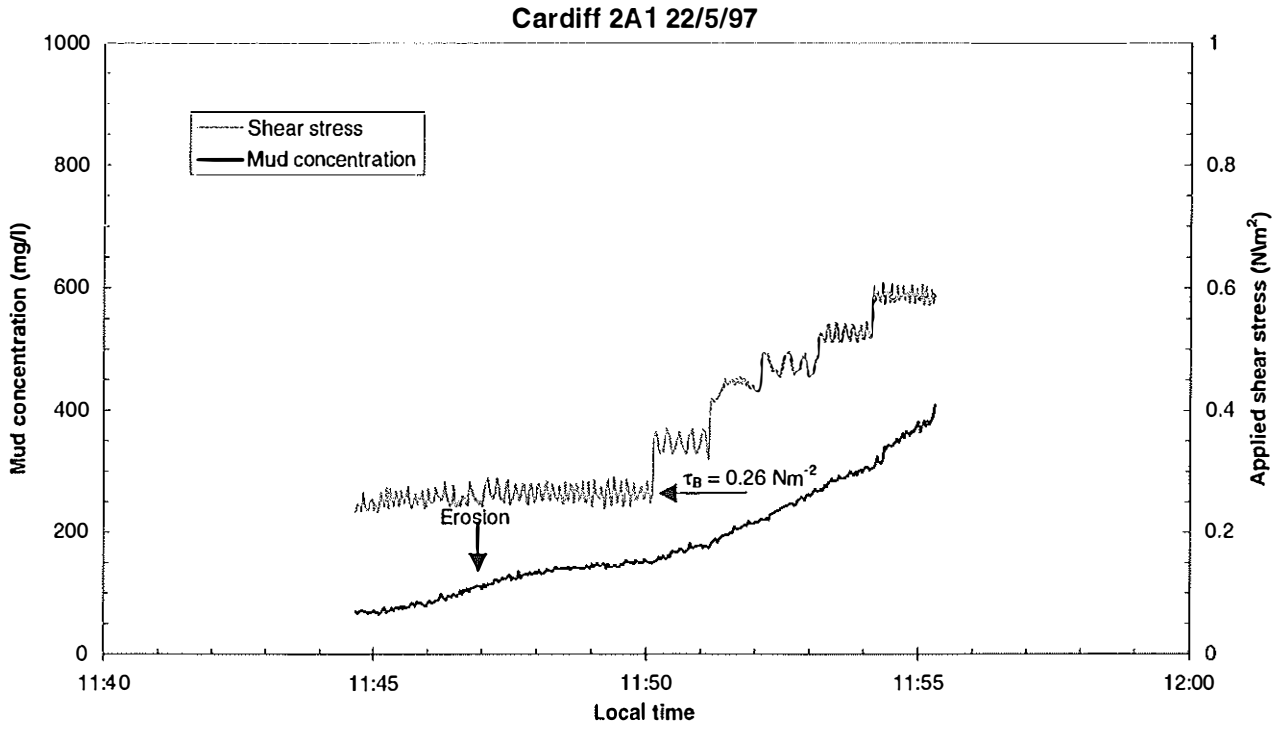

Cardiff 1CD3 22/4/97
Mud concentration (mg/l)
Applied shear stress (Nm-2)
0
200
400
600
800
1000
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Cardiff 1CD3 22/4/97
Mud concentration (mg/l)
Applied shear stress (Nm-2)
1
10
100
1000
10000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Cardiff 1CD3 22/4/97
Erosion rate (kgm-2s-1)
Applied shear stress (Nm-2)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

# SedErode Data Plots

## Cardiff May 1997




**Site:** **Cardiff seasonal survey May 1997**
Time: 11:38
Date: 22/05/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay001.l01

**Site description:**
texture: medium, soft (jelly like)
colour: mid brown
covering: Tiny shell fragments
topography: no algae, but worm tracks
biologically activity: worm holes, few hydrobia snails
composition: smooth mud, no sand, homogeneous
other features: Tiny pits on surface (approx 5/10cm diameter) Situated approx 0.5m from drainage runnels

**Surface sample:** (from top 5mm) - SM2

| | | |
|---|---|---|
| Water content: | 172 | % of dry weight |
| Bulk density: | 1303 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.30 | % by weight |
| Median size d50: | 3.3 | microns |
| Sand content: | 0.8 | % by weight |
| Silt content: | 59.1 | % by weight |
| Clay content: | 40.1 | % by weight |
| Mud Temperature: | 10.9 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.3, 0.7, 0.3, 0.9, 0.7
Average: 0.6

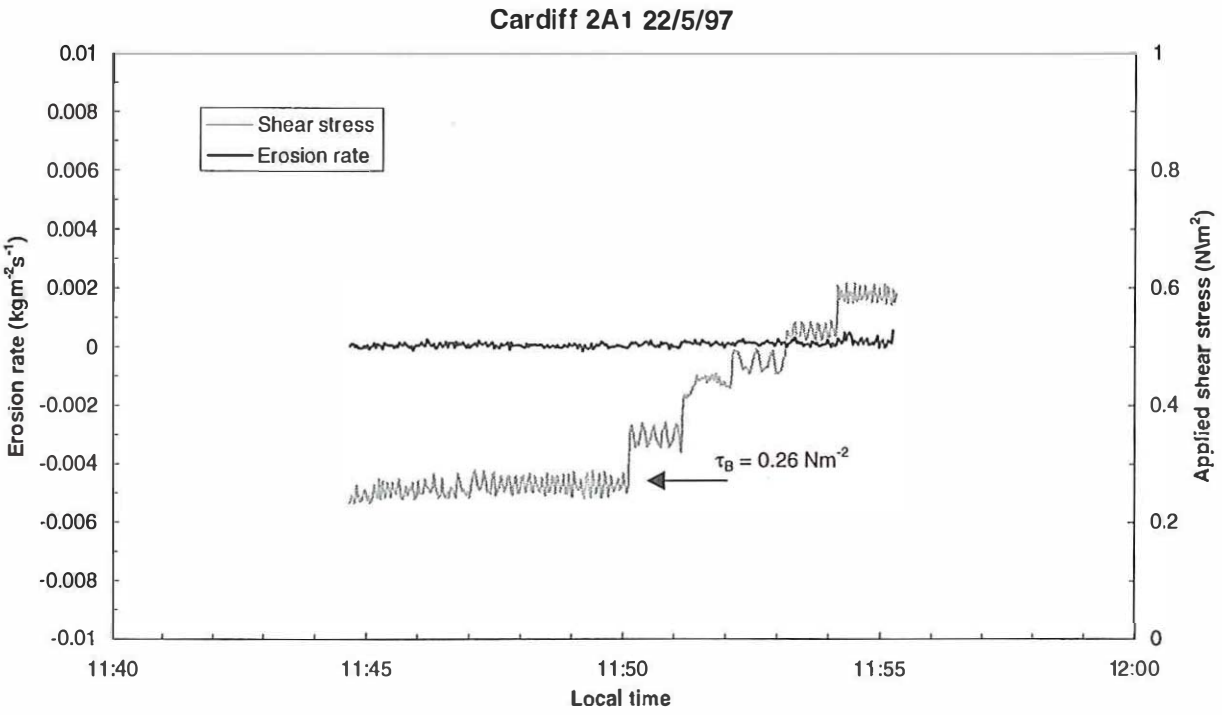
**Eroding Water:** (local collected at HW)
Salinity : 20.36

**Photographs:** Film: 1
Time: 11:35 Number: 8 Before erosion

**Comments:**

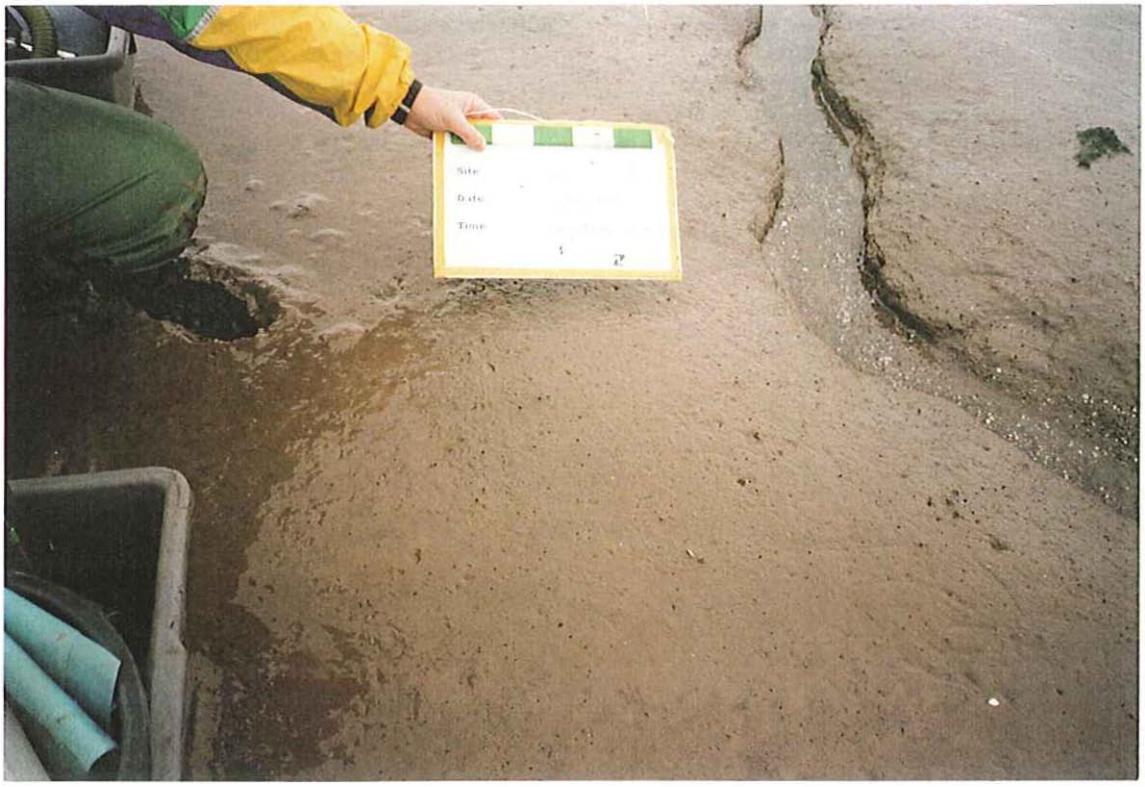
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

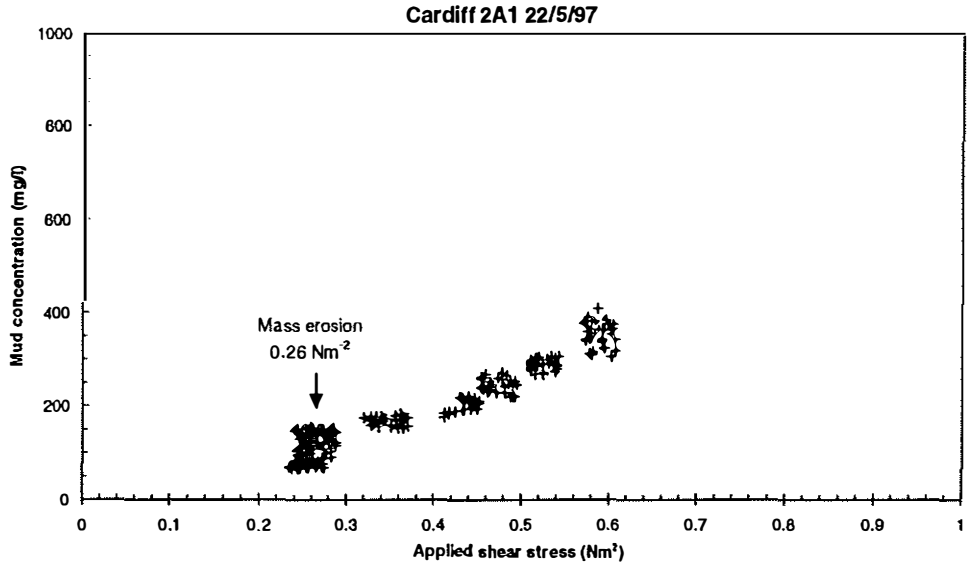
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.00** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.26** | **Nm$^{-2}$** |
| **Average** | **0.13** | **Nm$^{-2}$** |

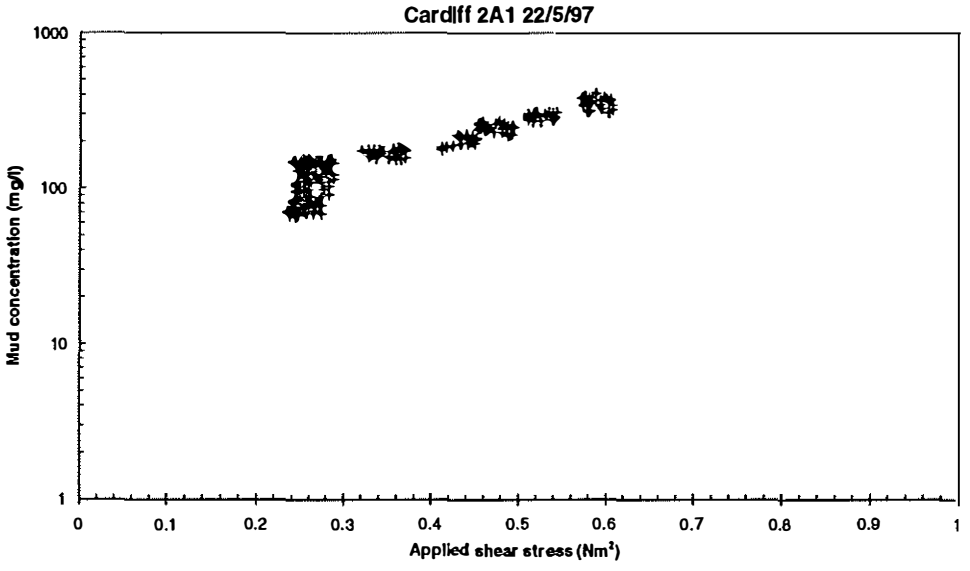


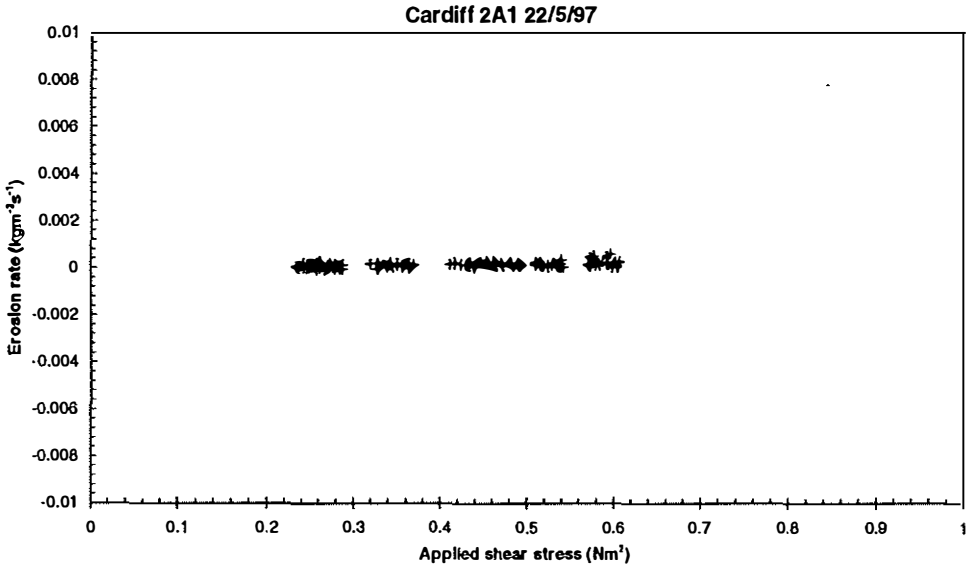

**Site:** **Cardiff seasonal survey May 1997**
Time: 11:38
Date: 22/05/97
Operator: H.J.Mitchener

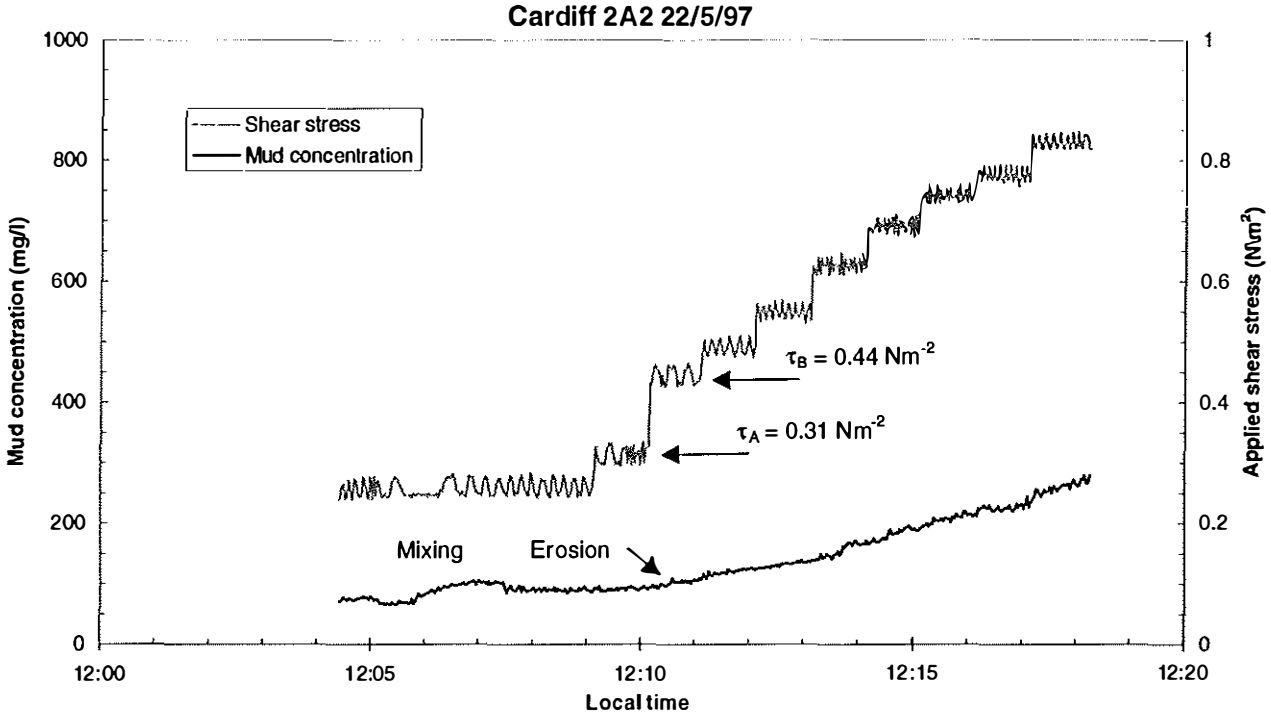
**Photographs:** Film: 1
Time: 11:35 Number: 8 Before erosion




Cardiff 2A1 22/5/97
Mud concentration (mg/l)
1000
600
600
400
200
0
Mass erosion
0.26 Nm-2
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm2)


Cardiff 2A1 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm2)


Cardiff 2A1 22/5/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm2)




**Site:** **Cardiff seasonal survey May 1997**
Time: 12:00
Date: 22/05/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay002.l01

**Site description:**
texture: medium, soft (jelly like)
colour: mid brown
covering: Tiny shell fragments
topography: no algae, but worm tracks
biologically activity: worm holes, few hydrobia
composition: smooth mud, no sand, homogeneous
other features: Tiny pits on surface (approx 5/10cm diameter) 1m upshore of site A1, 0.5m from drainage runnel

**Surface sample:** (from top 5mm) - SM5

| | | |
|---|---|---|
| Water content: | 136 | % of dry weight |
| Bulk density: | 1360 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 7.39 | % by weight |
| Median size d50: | 6.1 | microns |
| Sand content: | 2.2 | % by weight |
| Silt content: | 67.6 | % by weight |
| Clay content: | 30.2 | % by weight |
| Mud Temperature: | 10.7 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.0, 1.0, 0.8, 1.0, 0.8
Average: 0.9

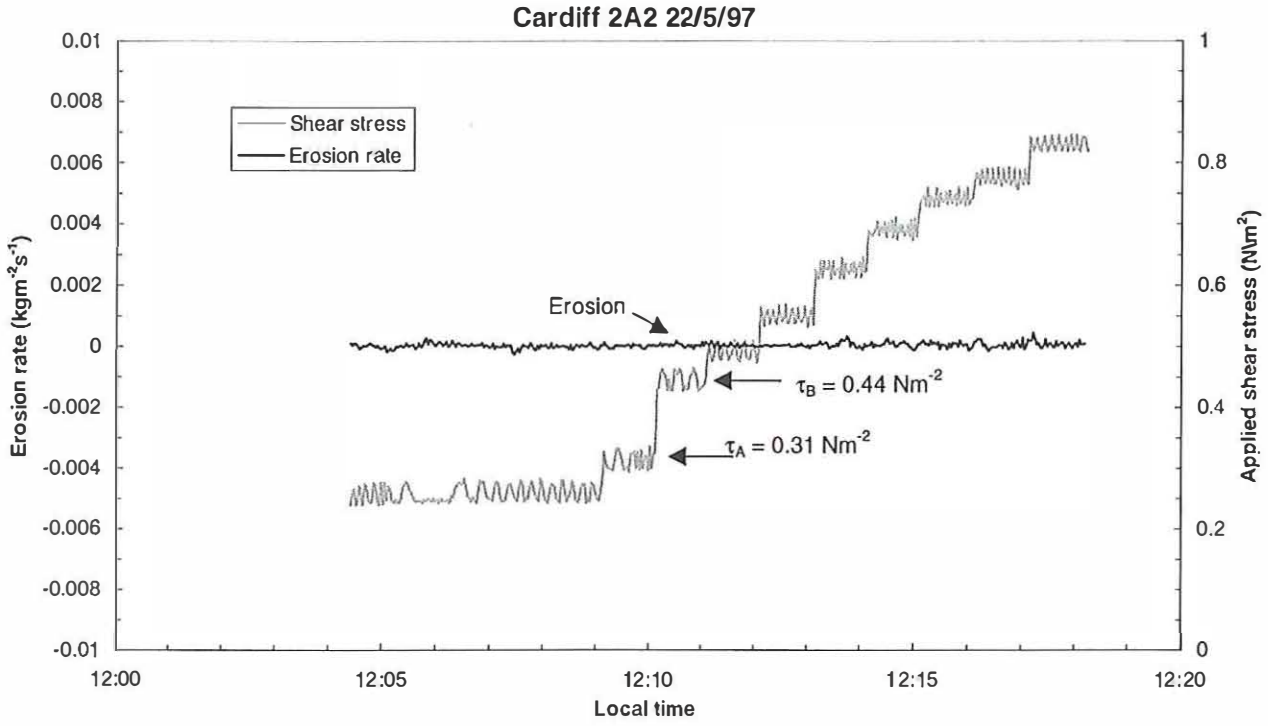
**Eroding Water:** (local collected at HW)
Salinity : 20.36

**Photographs:** Film: 1
Number: 9 Before erosion

**Comments:**

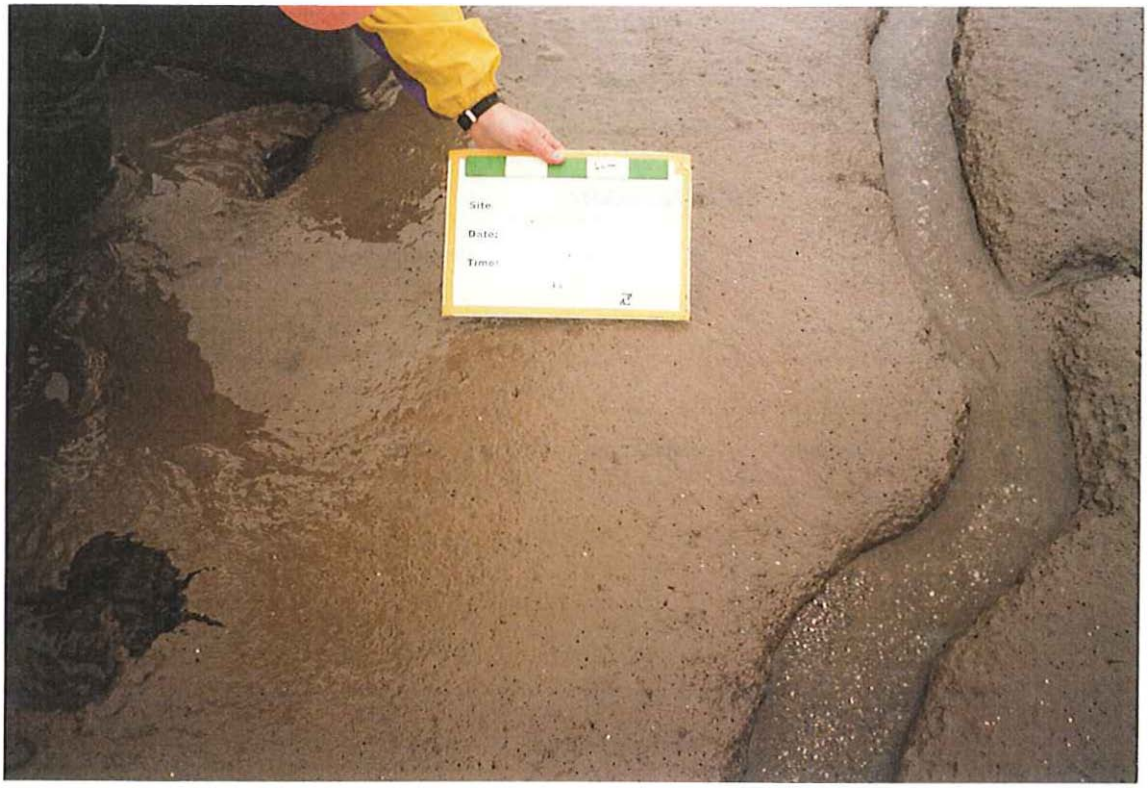
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

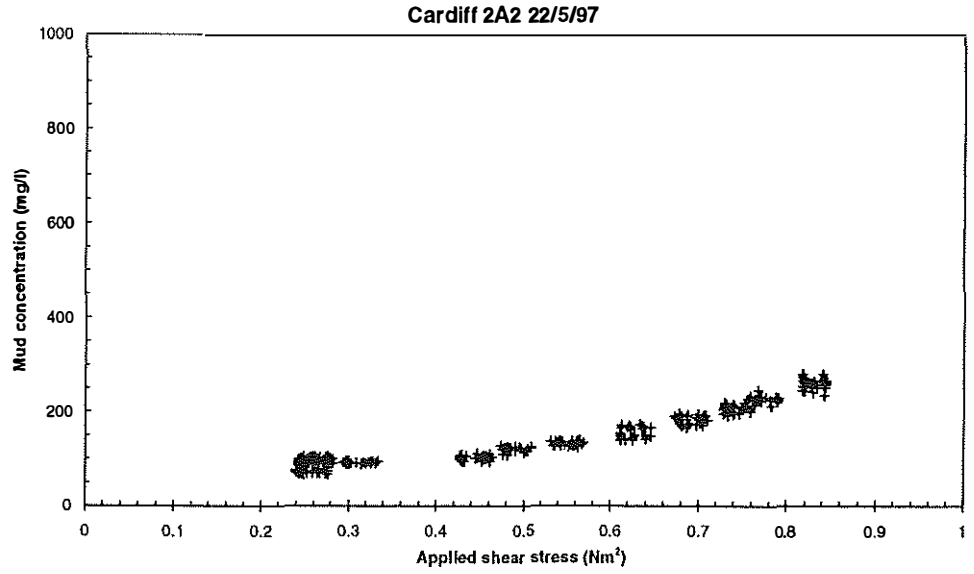
| | | |
|---|---|---|
| $\tau_A$ = | **0.31** | **Nm$^{-2}$** |
| $\tau_B$ = | **0.44** | **Nm$^{-2}$** |
| **Average** | **0.38** | **Nm$^{-2}$** |

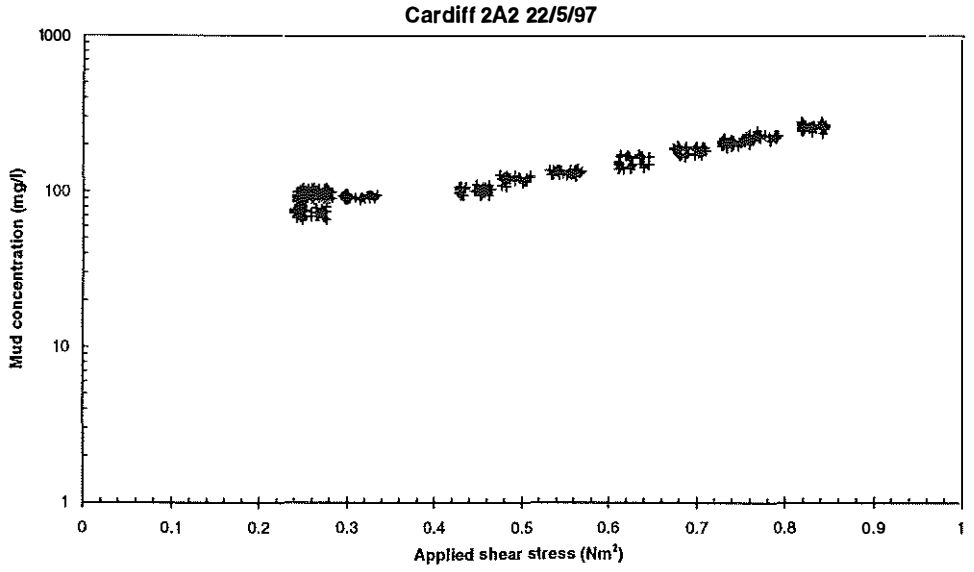


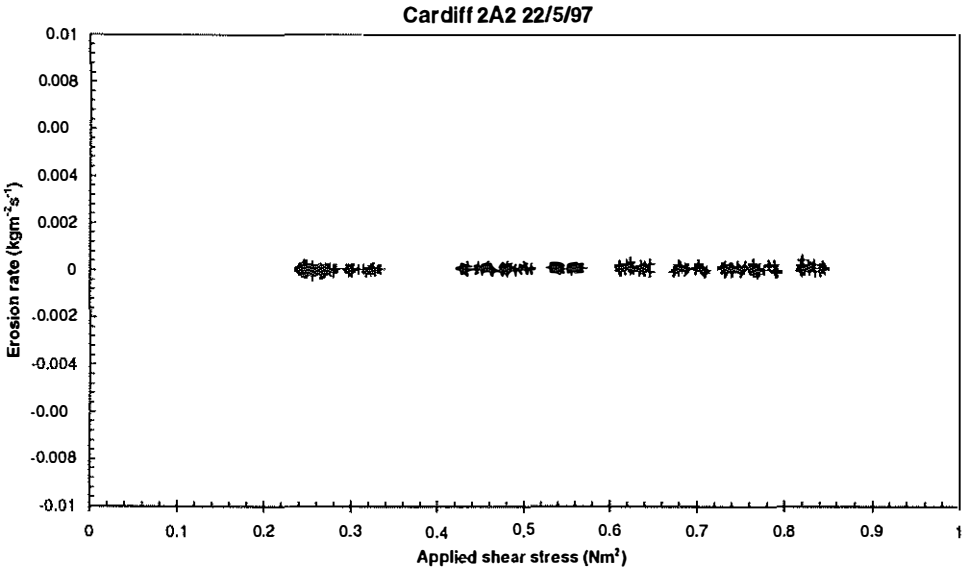

**Site:** **Cardiff seasonal survey May 1997**
Time: 12:00
Date: 22/05/97
Operator: H.J.Mitchener

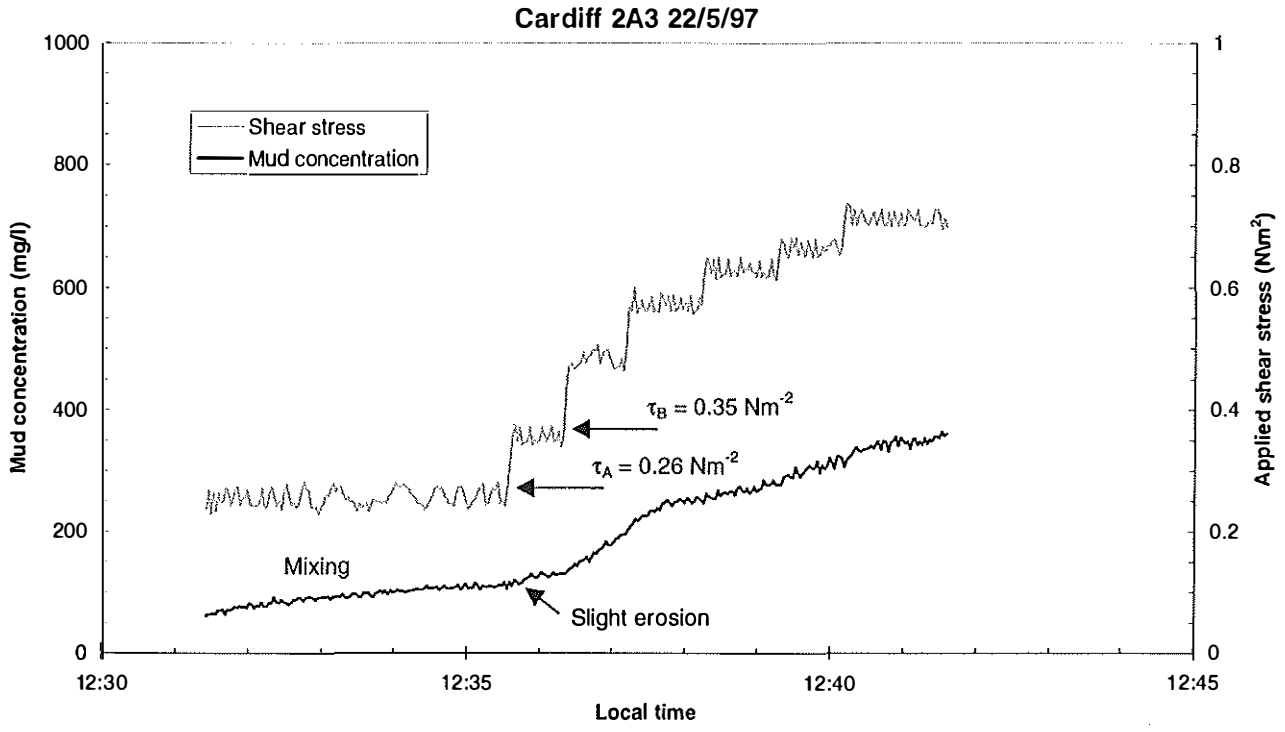
**Photographs:** Film: 1
Number: 9 Before erosion




Cardiff 2A2 22/5/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2A2 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2A2 22/5/97
Erosion rate (kgm⁻²s⁻¹)
0.01
0.008
0.00
0.004
0.002
0
-0.002
-0.004
-0.00
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)




**Site:** **Cardiff seasonal survey May 1997**
Time: 12:30
Date: 22/05/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay003.l01

**Site description:**
texture: medium, soft (jally like)
colour: mid brown
covering: Tiny shell fragments
topography: no algae, but worm tracks
biologically activity: worm holes, few hydrobia
composition: smooth mud, no sand, homogeneous
other features: Tiny pits on surface (approx 5/10cm diameter). Approx. 1m upshore of site A2, 0.5m from drainage runnel

**Surface sample:** (from top 5mm) - SM8

| | | |
|---|---|---|
| Water content: | 142 | % of dry weight |
| Bulk density: | 1350 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 7.45 | % by weight |
| Median size d50: | 6.0 | microns |
| Sand content: | 1.8 | % by weight |
| Silt content: | 67.5 | % by weight |
| Clay content: | 30.7 | % by weight |
| Mud Temperature: | 11.1 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.7, 0.9, 0.8, 1.0, 0.9
Average: 0.9

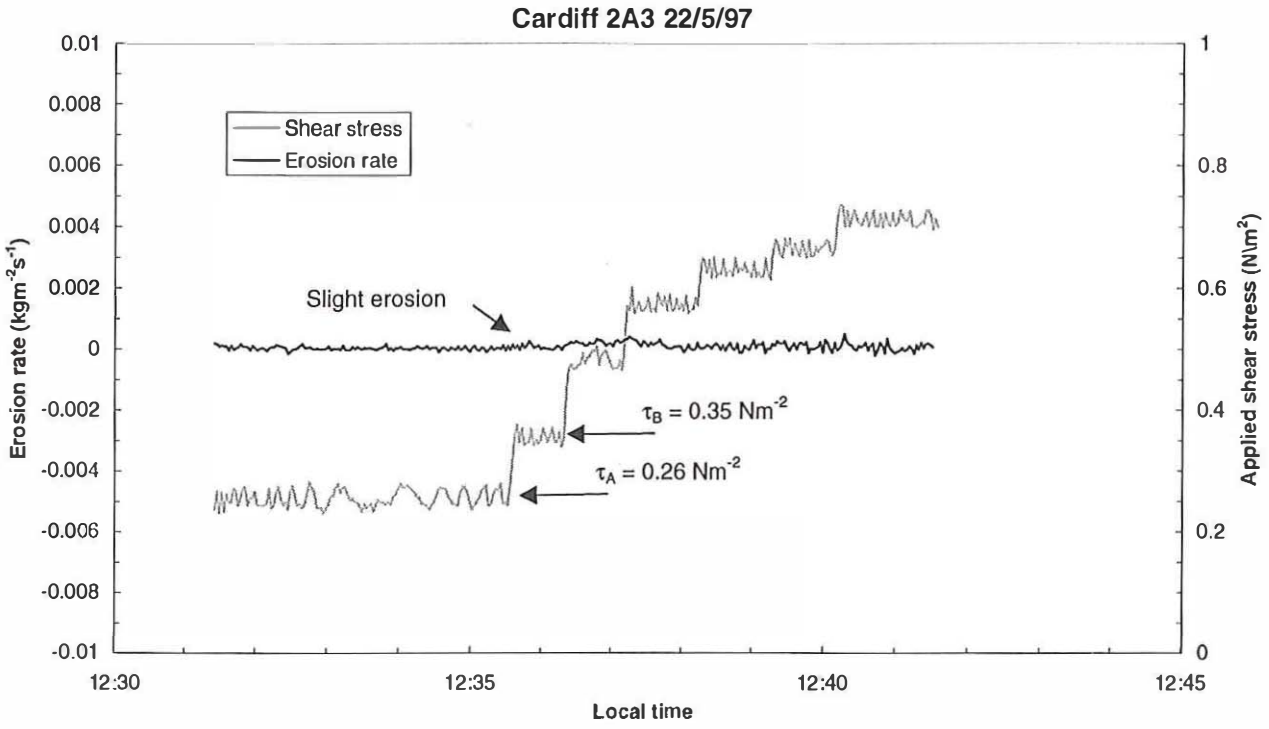
**Eroding Water:** (local collected at HW)
Salinity : 20.36

**Photographs:** Film: 1
Number: 11 Before erosion

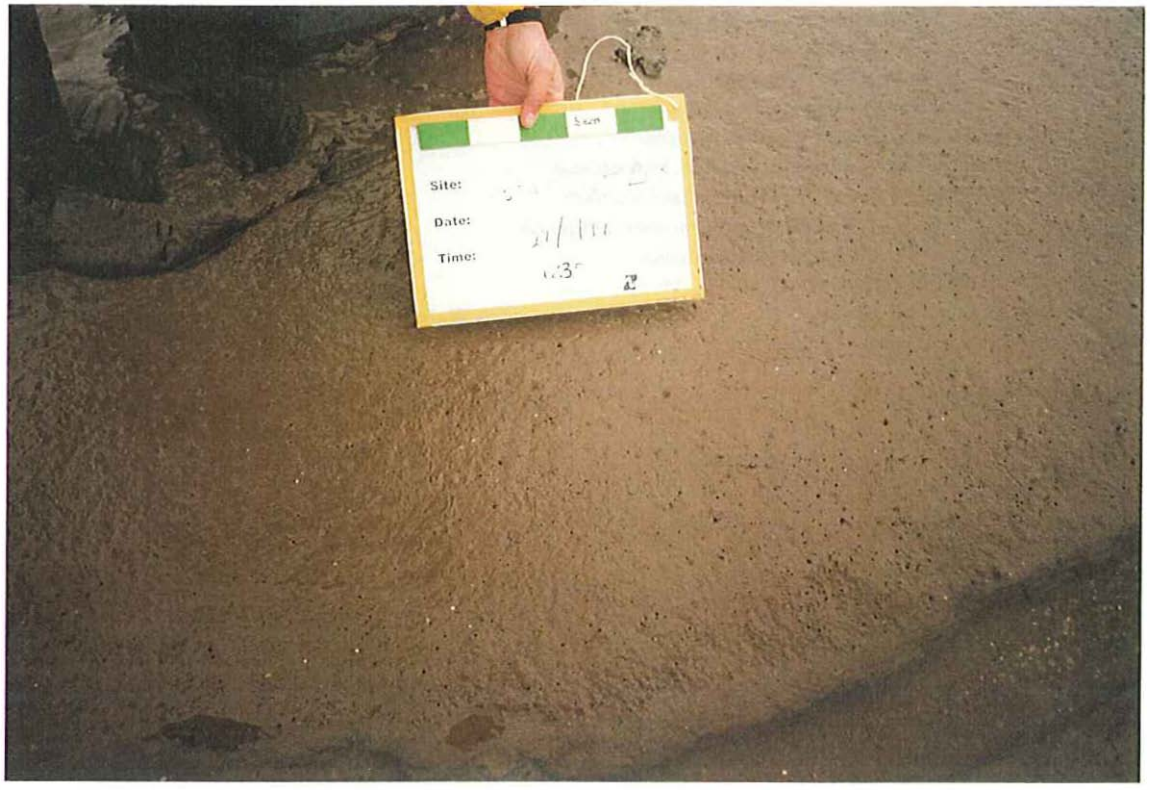
**Comments:**

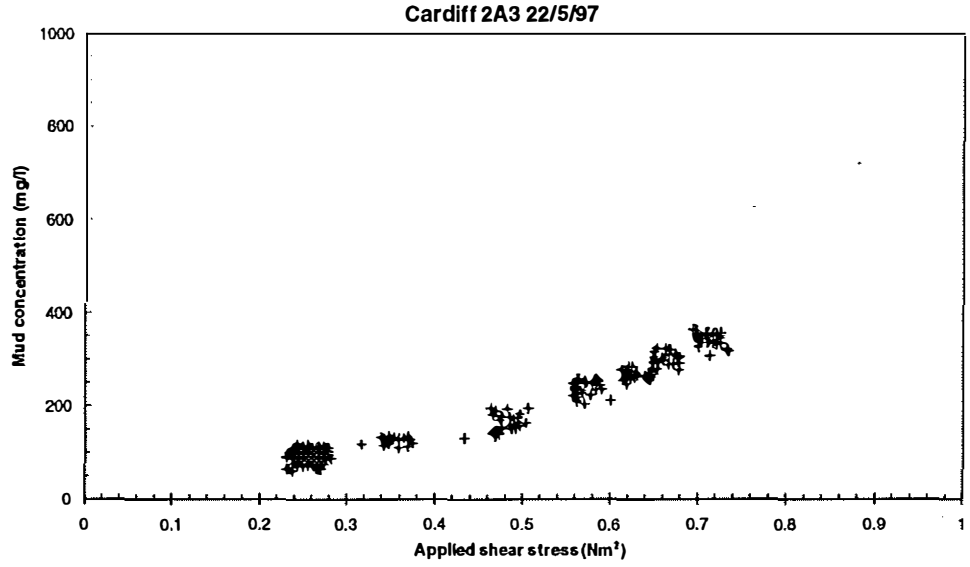
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

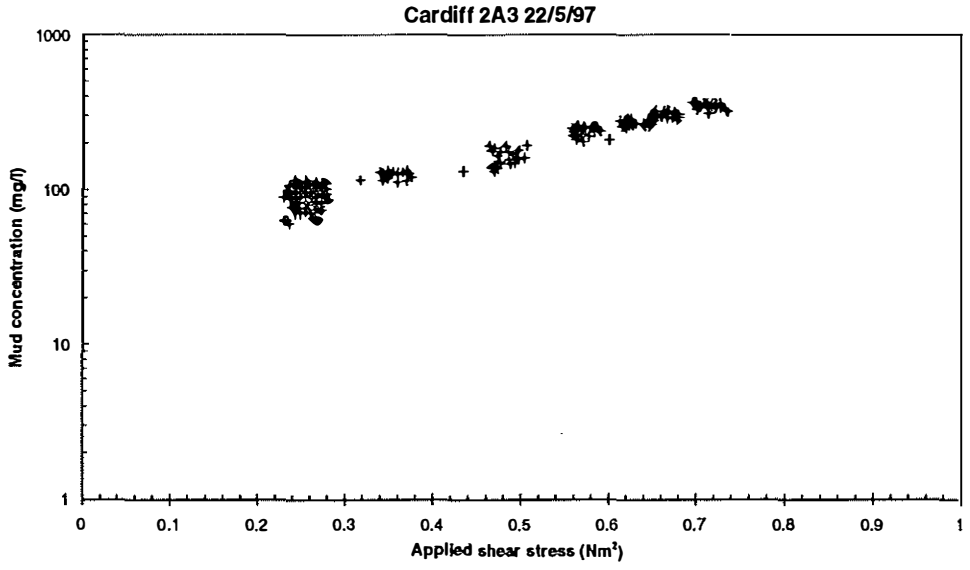
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.26** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.35** | **Nm$^{-2}$** |
| **Average** | **0.30** | **Nm$^{-2}$** |

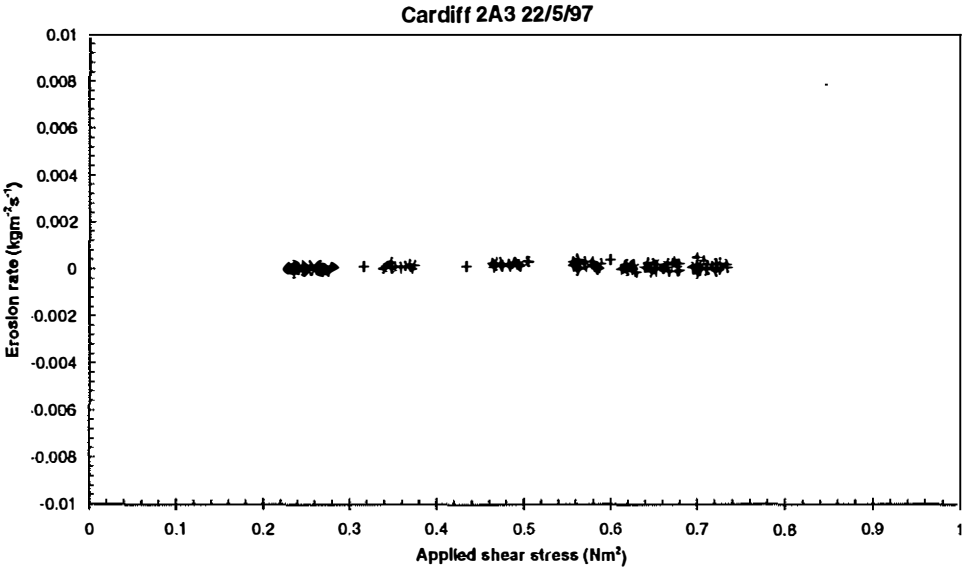


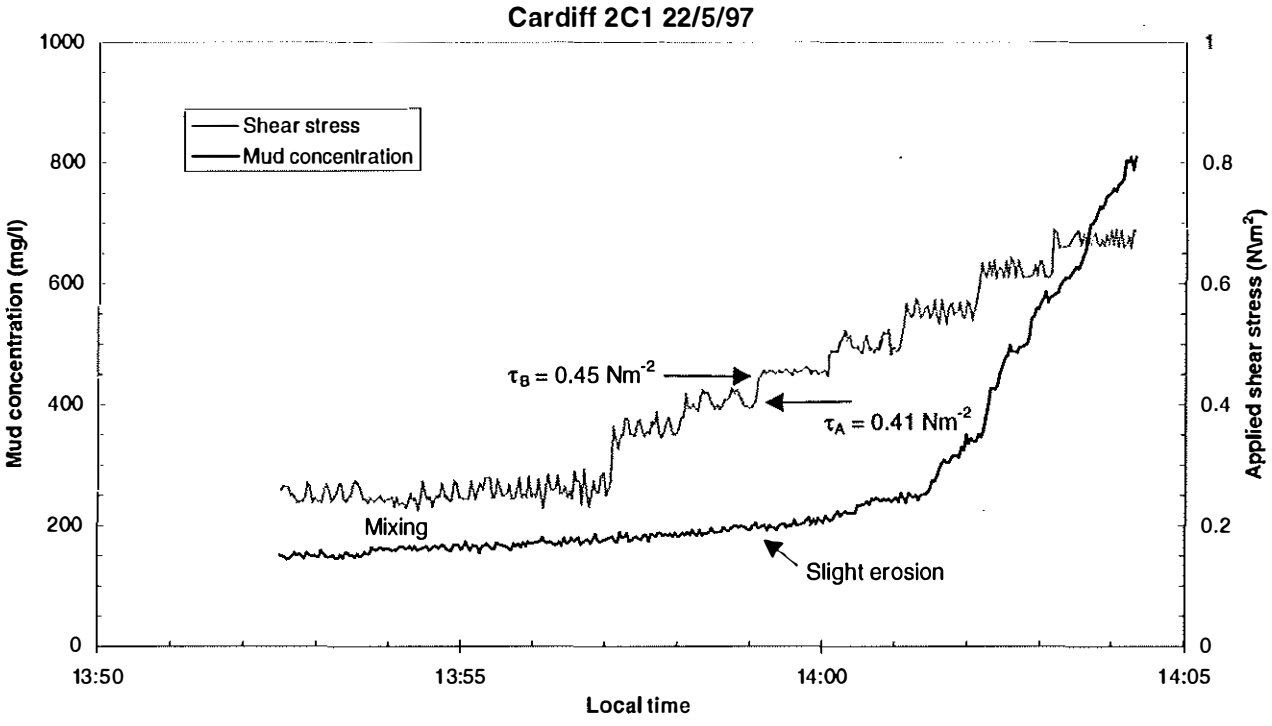

**Site:** Cardiff seasonal survey May 1997 **Photographs:** Film: 1
Time: 12:30 Number: 11 Before erosion
Date: 22/05/97
Operator: H.J.Mitchener




Cardiff 2A3 22/5/97
Mud concentration (mg/l)
1000
600
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2A3 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2A3 22/5/97
Erosion rate (kgm⁻²s⁻¹)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)




**Site:** **Cardiff seasonal survey May 1997**
Time: 13:45
Date: 22/05/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay004.l01

**Site description:**
texture: medium, gelatinous
colour: pale brown
covering: worm pits and feeding marks
topography: ± 1mm
biologically activity: worms & tracks, hydrobia, no algae
composition: clay, silt, no sand, homogeneous
other features: 1m to left of runnel, deeper worms under surface, 5-10 pits/10cm diam, odd hydrobia on surface, 10-20/10cm diameter

**Surface sample:** (from top 5mm) - SM11

| | | |
|---|---|---|
| Water content: | 178 | % of dry weight |
| Bulk density: | 1295 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.32 | % by weight |
| Median size d50: | 2.9 | microns |
| Sand content: | 1.4 | % by weight |
| Silt content: | 58.9 | % by weight |
| Clay content: | 39.7 | % by weight |
| Mud Temperature: | 11.5 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.3, 0.3, 0.4, 0.1, 0.3
Average: 0.3

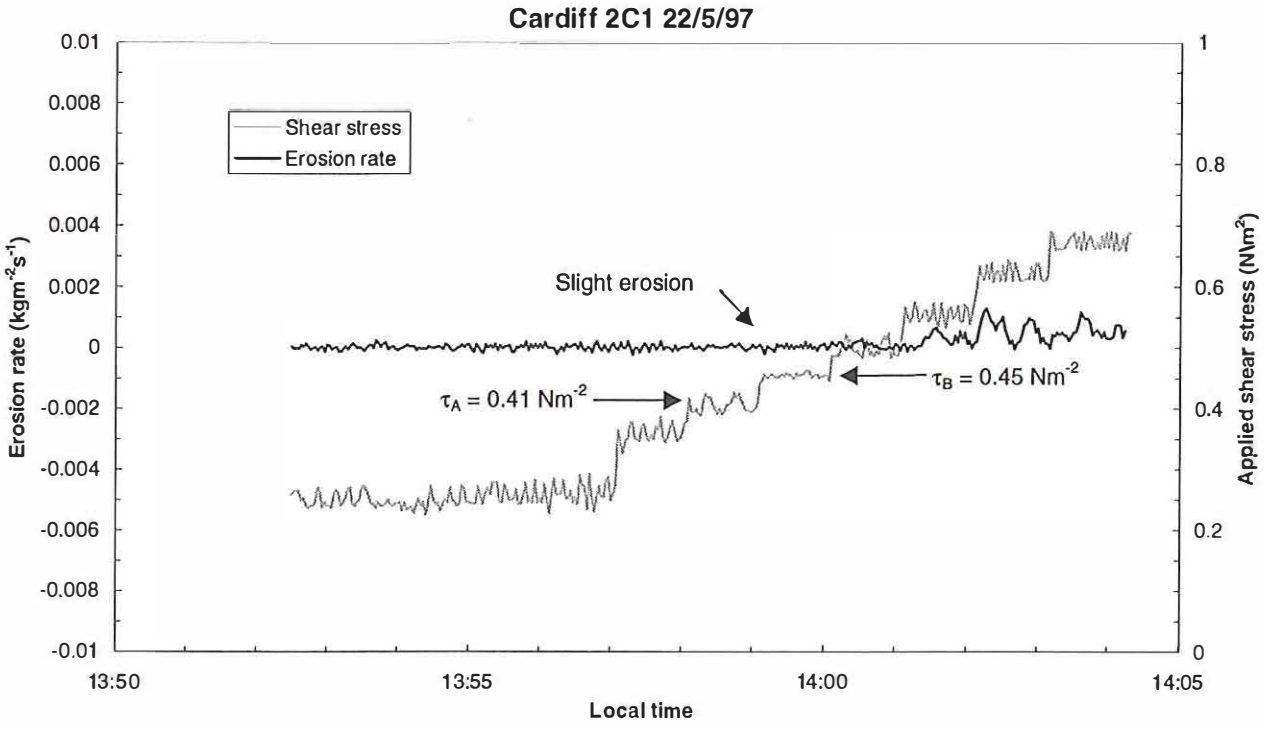
**Eroding Water:** (local collected at HW)
Salinity : 20.36

**Photographs:**
Film: 1
Number: 14 Before erosion
Number: 16 After erosion

**Comments:**

**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

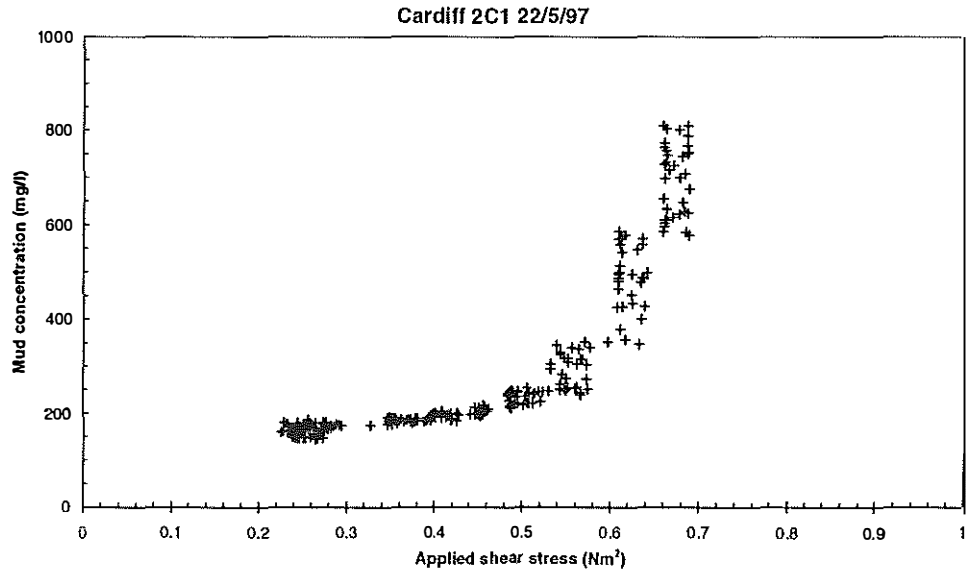
| | | |
|---|---|---|
| $\tau_A$ = | 0.41 | Nm$^{-2}$ |
| $\tau_B$ = | 0.45 | Nm$^{-2}$ |
| **Average** | 0.43 | Nm$^{-2}$ |

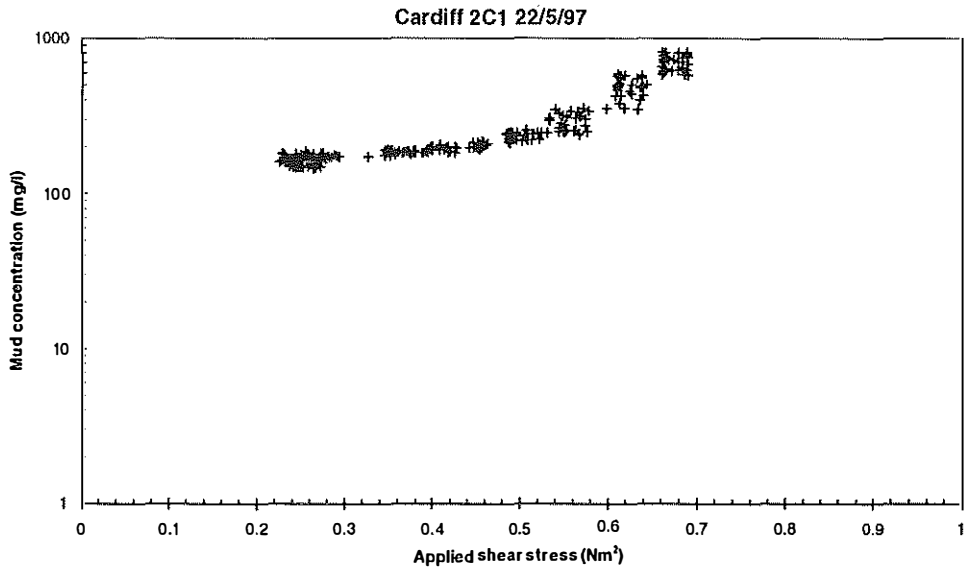


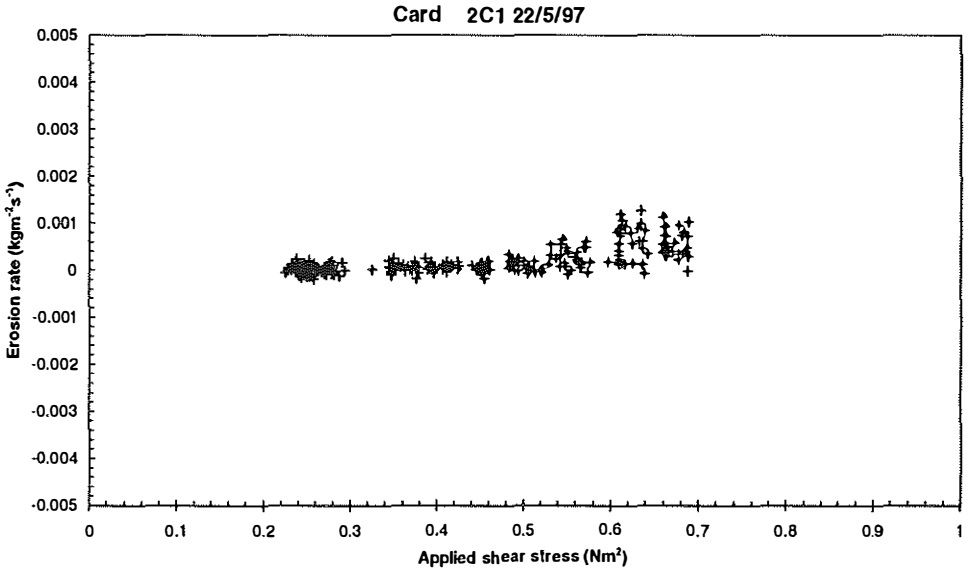

**Site:** **Cardiff seasonal survey May 1997**
Time: 13:45
Date: 22/05/97
Operator: H.J.Mitchener

**Photographs:**

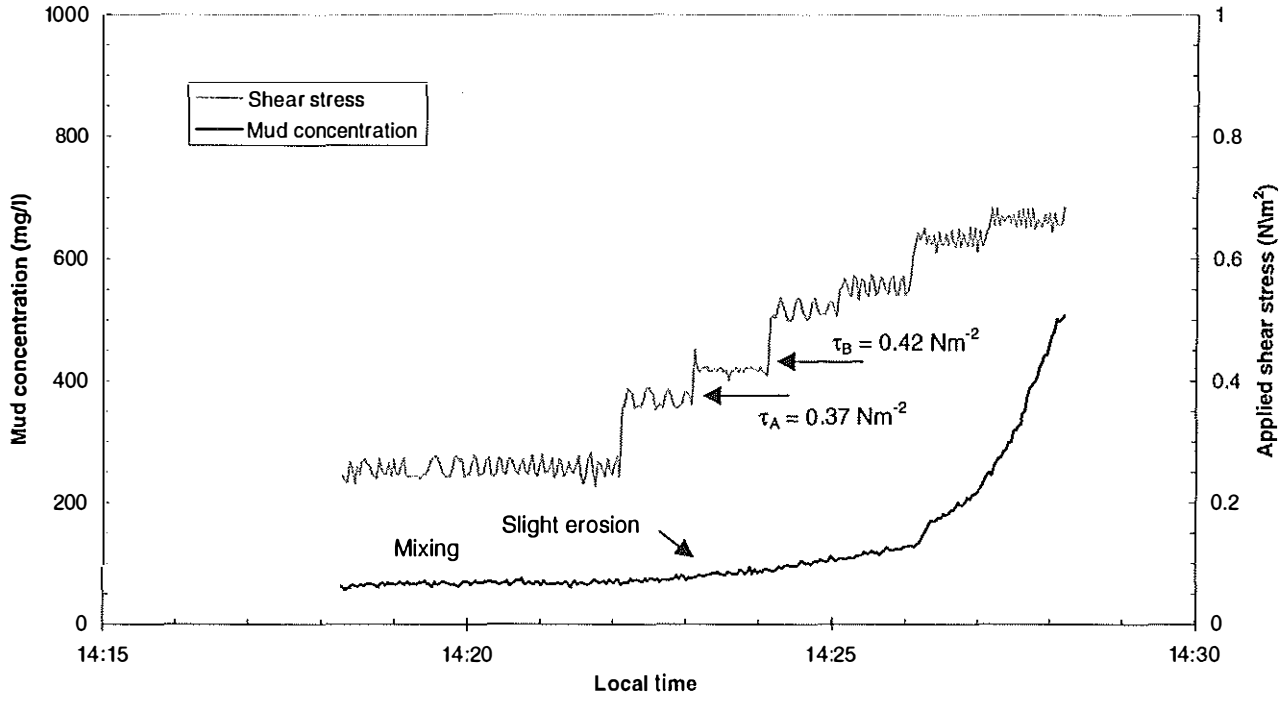
| | | |
|---|---|---|
| Film: | 1 | |
| Number: | 14 | Before erosion |
| Number: | 16 | After erosion |


Cardiff 2C1 22/5/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2C1 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Card 2C1 22/5/97
Erosion rate (kgm⁻²s⁻¹)
0.005
0.004
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
-0.004
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)

## Cardiff 2C2 22/5/97




**Site:** **Cardiff seasonal survey May 1997**
Time: 14:11
Date: 22/05/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay005.l01

**Site description:**
texture: medium, gelatinous
colour: pale brown
covering: worm pits and feeding marks, watery
topography: ± 1mm
biologically activity: worms & tracks, hydrobia, no algae
composition: clay, silt, no sand, homogeneous
other features: between runnels, worms/pits 5-10/10cm diameter, hydrobia 10-20/10cm diamater. Approx 2m from C1

**Surface sample:** (from top 5mm) - SM14

| | | |
|---|---|---|
| Water content: | 184 | % of dry weight |
| Bulk density: | 1287 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.51 | % by weight |
| Median size d50: | 2.6 | microns |
| Sand content: | 0.4 | % by weight |
| Silt content: | 56.4 | % by weight |
| Clay content: | 45.2 | % by weight |
| Mud Temperature: | 12.1 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.2, 0.5, 0.5, 0.3, 0.2
Average: 0.3

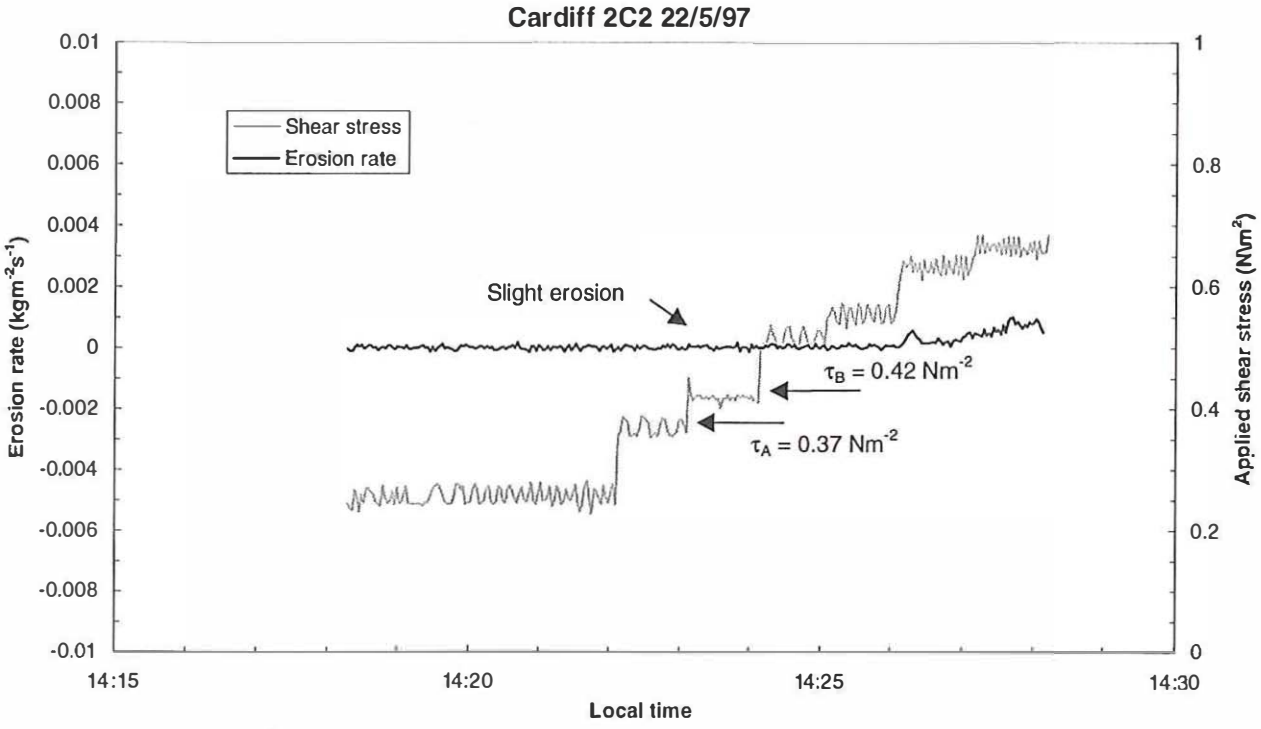
**Eroding Water:** (local collected at HW)
Salinity : 20.36

**Photographs:**
Film: 1
Number: 15 Before erosion

**Comments:**

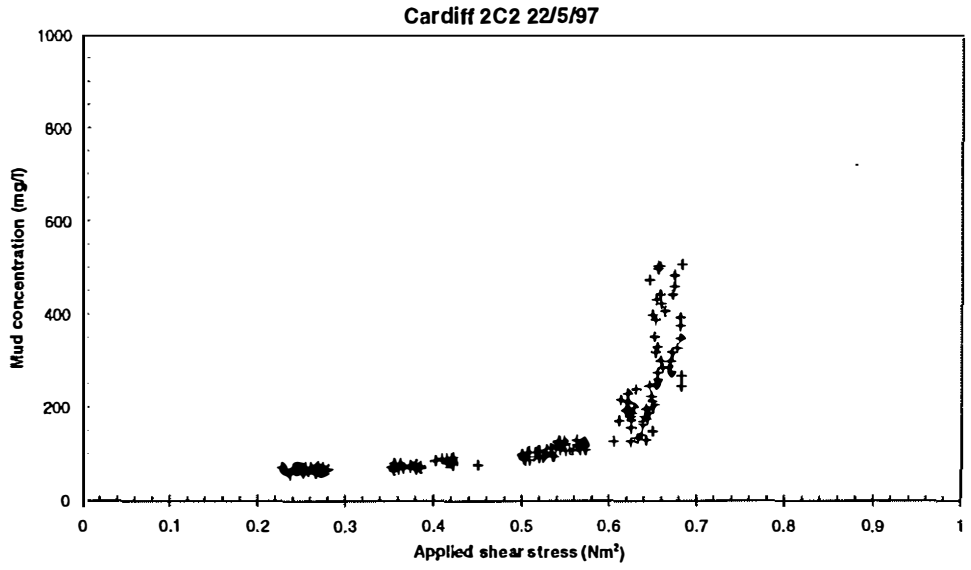
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

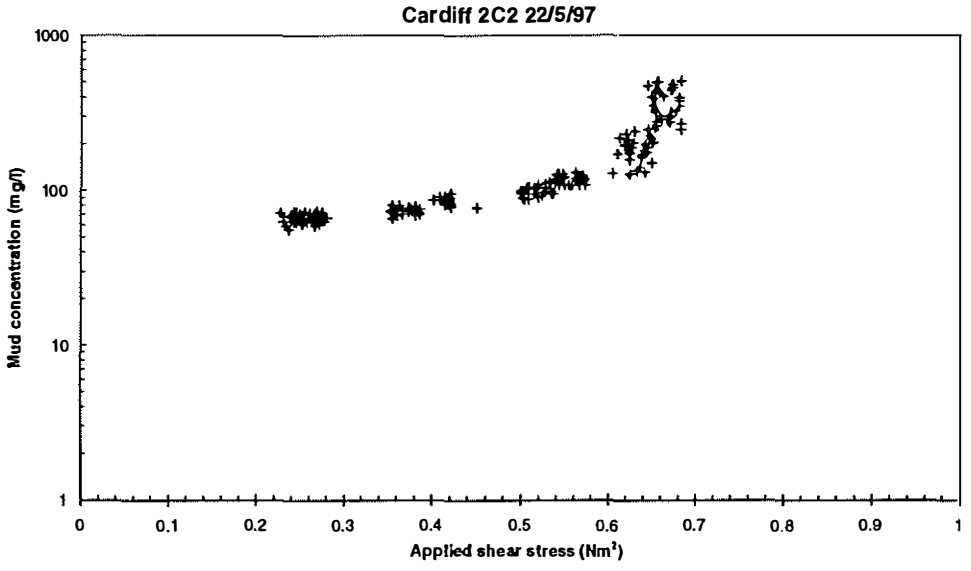
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.37** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.42** | **Nm$^{-2}$** |
| **Average =** | **0.39** | **Nm$^{-2}$** |

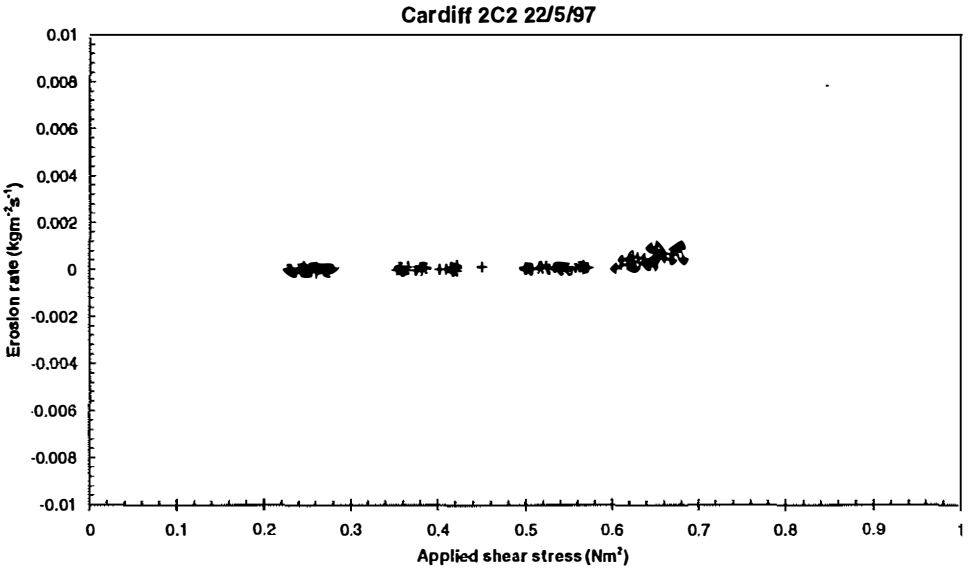


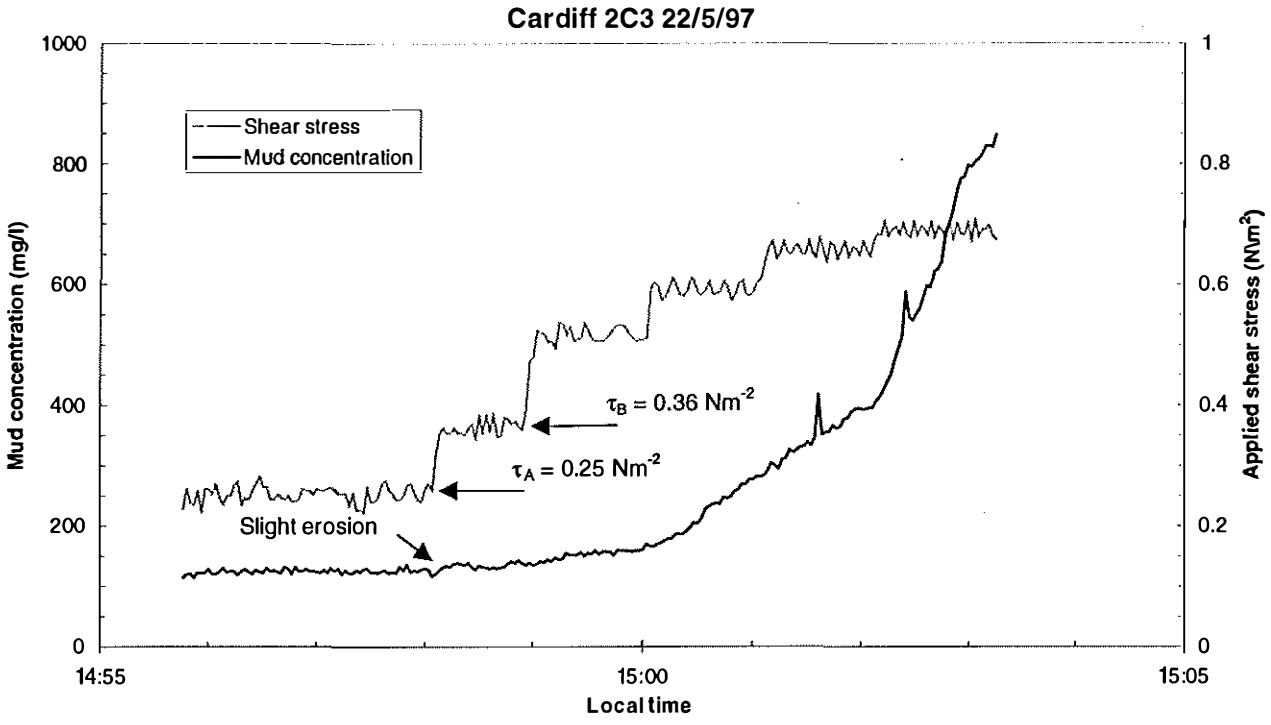

**Site:** **Cardiff seasonal survey May 1997**
Time: 14:11
Date: 22/05/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Number: 15 Before erosion


Cardiff 2C2 22/5/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2C2 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2C2 22/5/97
Erosion rate (kgm⁻²s⁻¹)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)




**Site:** **Cardiff seasonal survey May 1997**
Time: 14:48
Date: 22/05/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay006.l01

**Site description:**
texture: medium, gelatinous
colour: pale brown
covering: scant water, pits, feeding marks
topography: ± 1mm
biologically activity: worms & hydrobia
composition: clay/silt, no sand, homogeneous
other features: raining, grey sediment under surface

**Surface sample:** (from top 5mm) - SM17

| | | |
|---|---|---|
| Water content: | 179 | % of dry weight |
| Bulk density: | 1294 | $kgm^{-3}$ |
| Carbon (loss on Ignition): | 9.53 | % by weight |
| Median size d50: | 3.6 | microns |
| Sand content: | 1.6 | % by weight |
| Silt content: | 60.3 | % by weight |
| Clay content: | 38.1 | % by weight |
| Mud Temperature: | 11.6 | $^0C$ |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.3
0.2
0.2
0.3
0.1
Average: 0.2

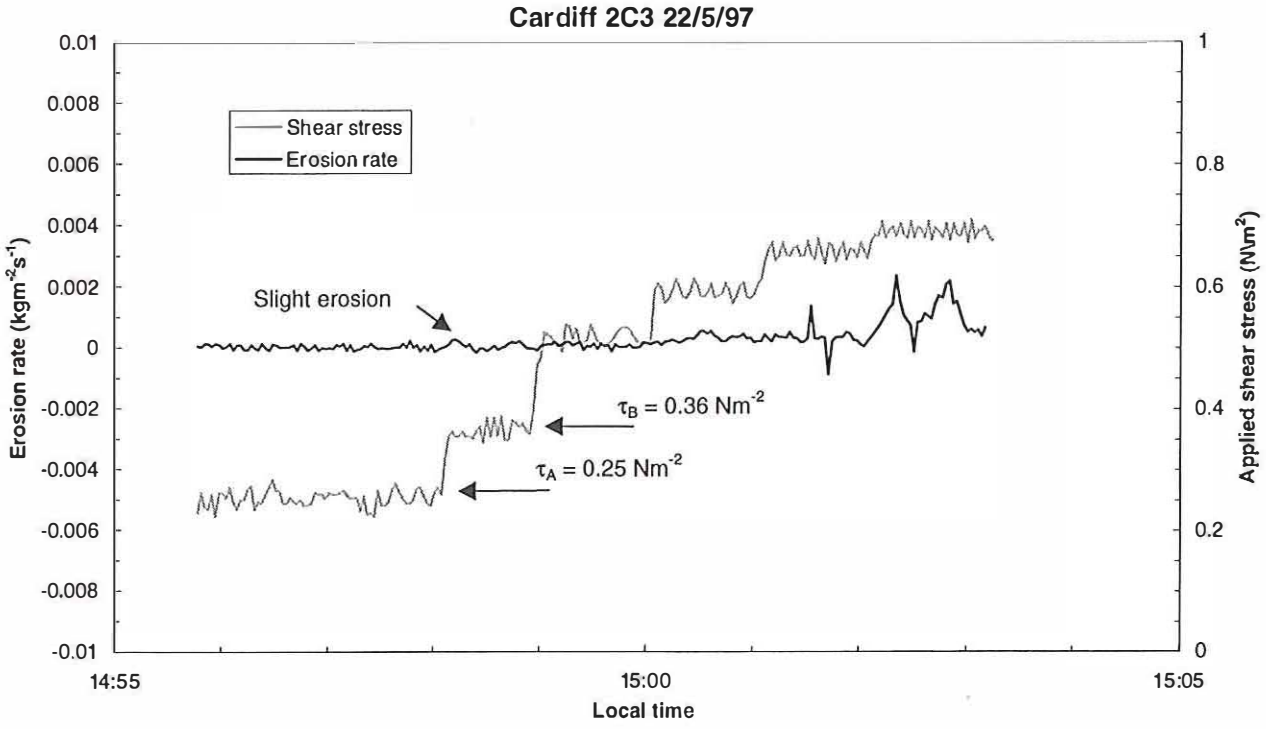
**Eroding Water:** (local collected at HW)
Salinity : 20.36

**Photographs:** Film: 1
Number: 19 Before erosion

**Comments:**

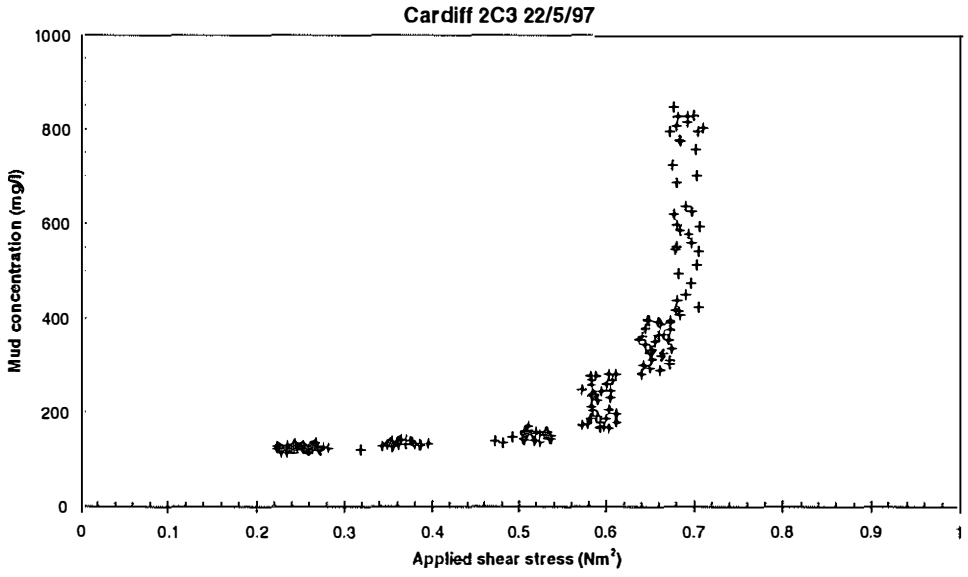
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

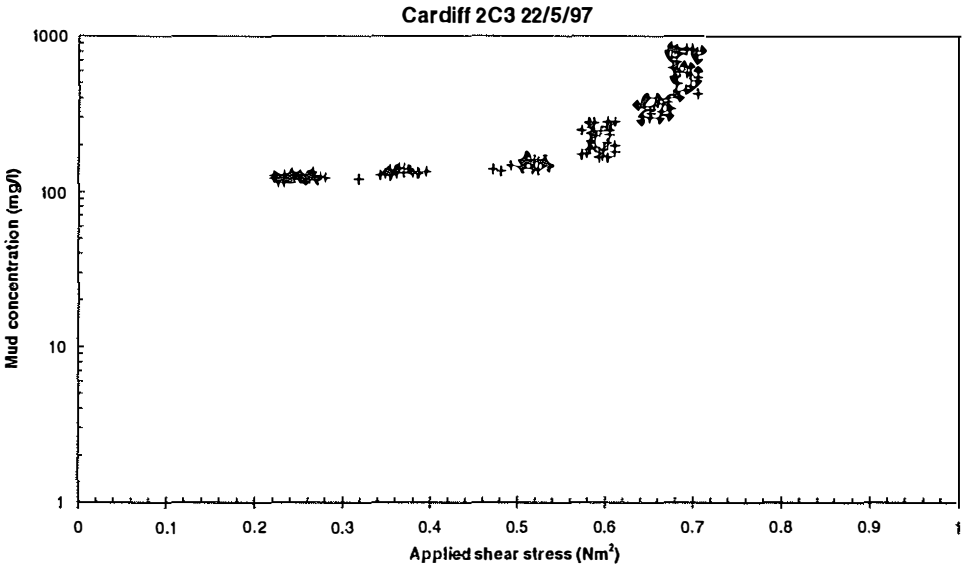
| | | |
|---|---|---|
| $\tau_A$ = | **0.25** | $Nm^{-2}$ |
| $\tau_B$ = | 0.36 | $Nm^{-2}$ |
| **Average =** | **0.31** | $Nm^{-2}$ |

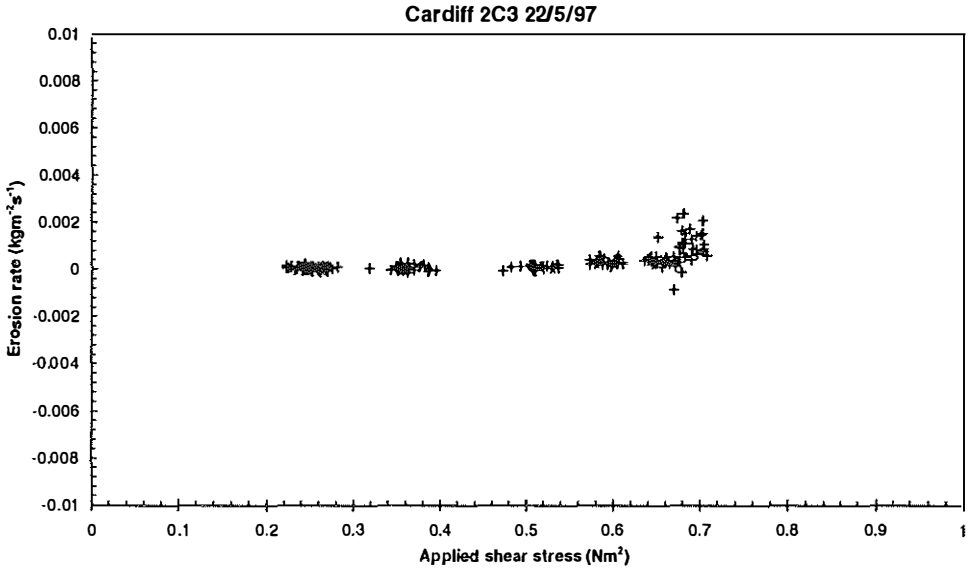


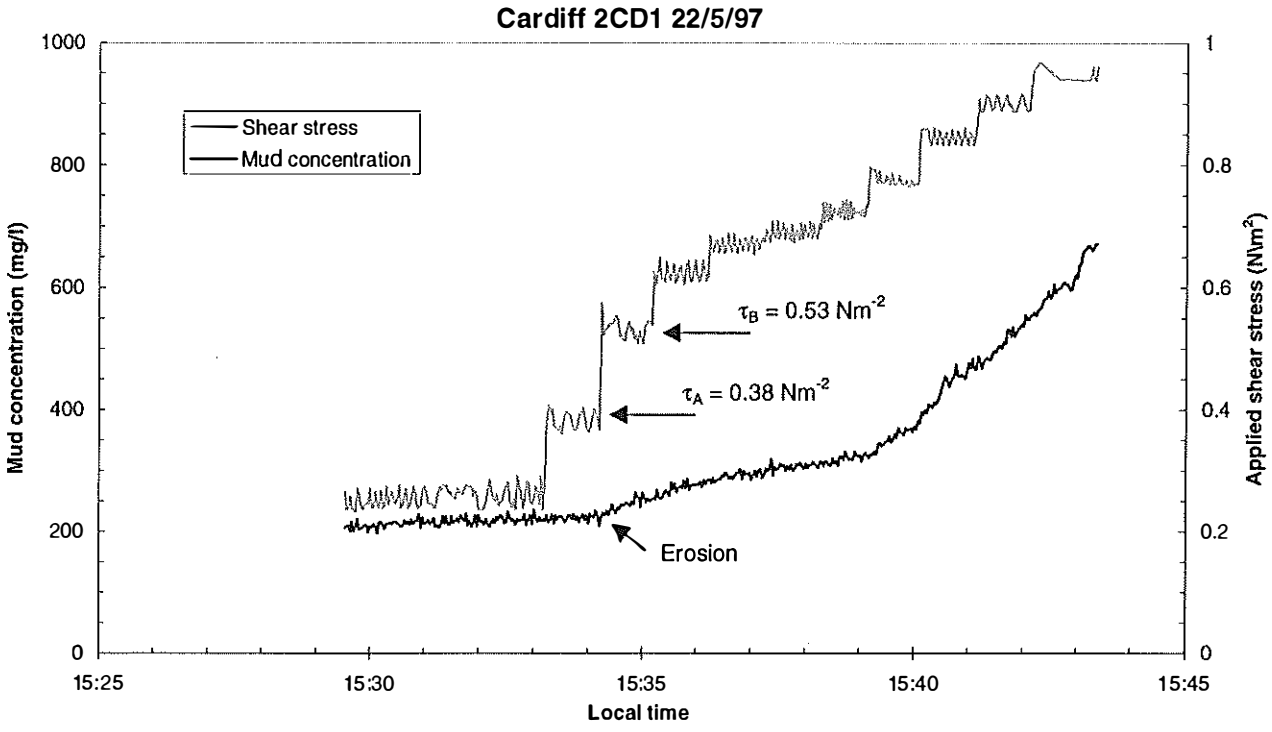

**Site:** **Cardiff seasonal survey May 1997**
Time: 14:48
Date: 22/05/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Number: 19 Before erosion


Cardiff 2C3 22/5/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm$^2$)


Cardiff 2C3 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm$^2$)


Cardiff 2C3 22/5/97
Erosion rate (kgm$^{-2}$s$^{-1}$)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm$^2$)




**Site:** **Cardiff seasonal survey May 1997**
Time: 15:20
Date: 22/05/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay007.l01

**Site description:**
texture: medium
colour: mid brown
covering: worm pits, few hydrobia, no algae
topography: ± 1mm
biologically activity: 1-2 hydrobia/10cm diamater
composition: clay/silt, homogenous
other features: positioned on a stiffer outcrop, close to drainage runnel. Raining

**Surface sample:** (from top 5mm) - SM20

| | | |
|---|---|---|
| Water content: | 161 | % of dry weight |
| Bulk density: | 1319 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.28 | % by weight |
| Median size d50: | 3.0 | microns |
| Sand content: | 0.1 | % by weight |
| Silt content: | 58.2 | % by weight |
| Clay content: | 41.7 | % by weight |
| Mud Temperature: | 10.8 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.1, 1.2, 1.2, 1.1, 1.2
Average: 1.2

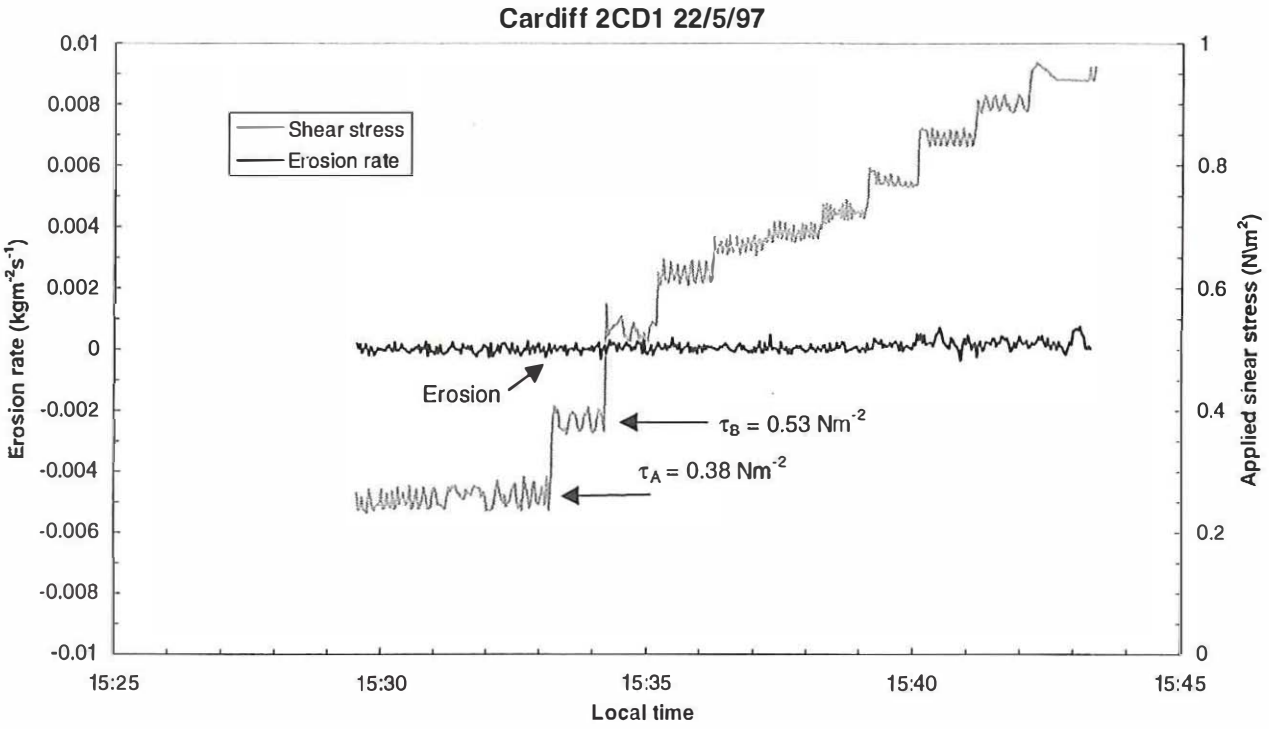
**Eroding Water:** (local collected at HW)
Salinity : 20.36

**Photographs:** Film: 1
Number: 20 Before erosion

**Comments:**

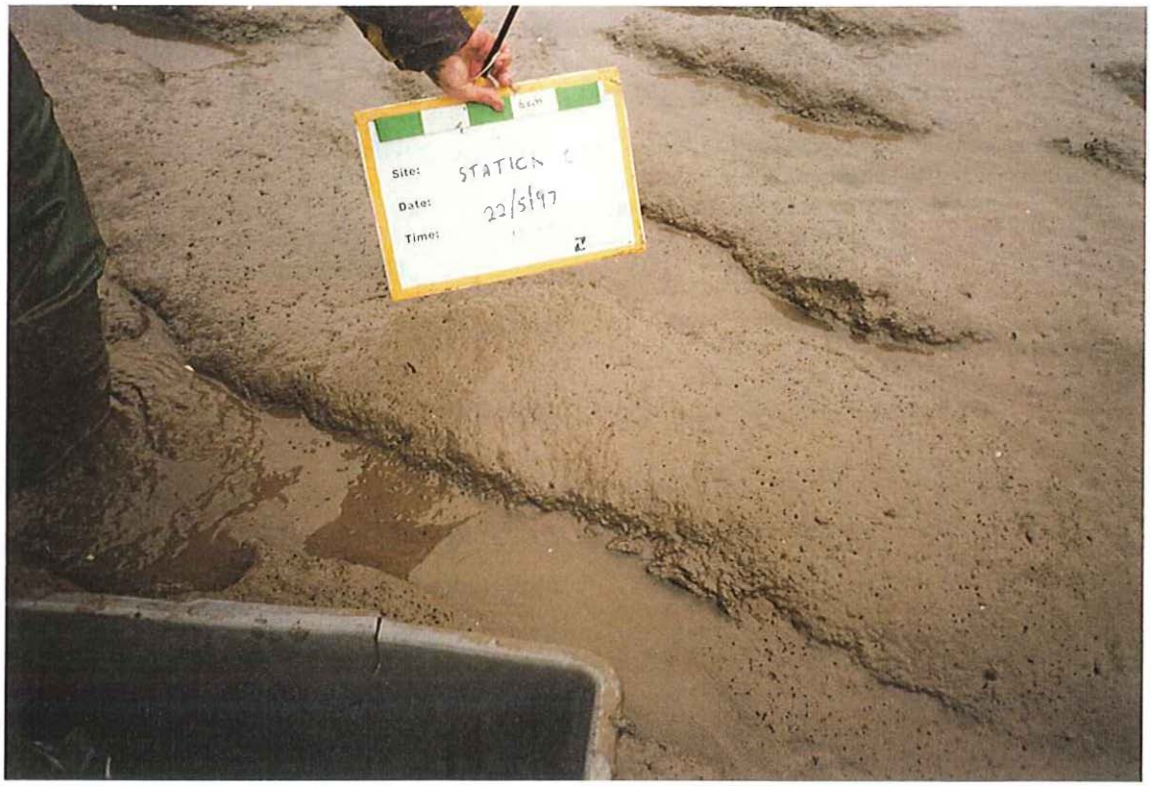
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

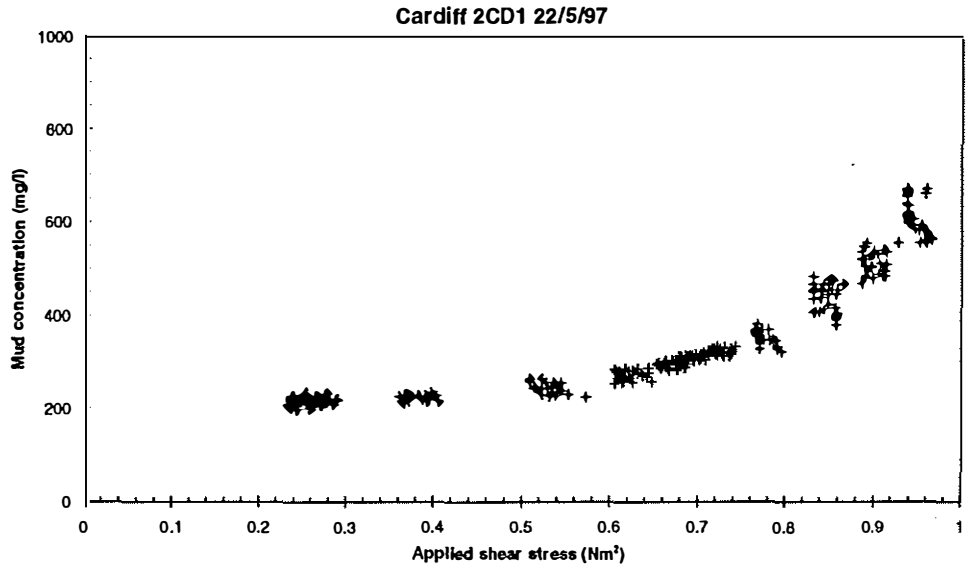
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.38** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.53** | **Nm$^{-2}$** |
| **Average =** | **0.46** | **Nm$^{-2}$** |

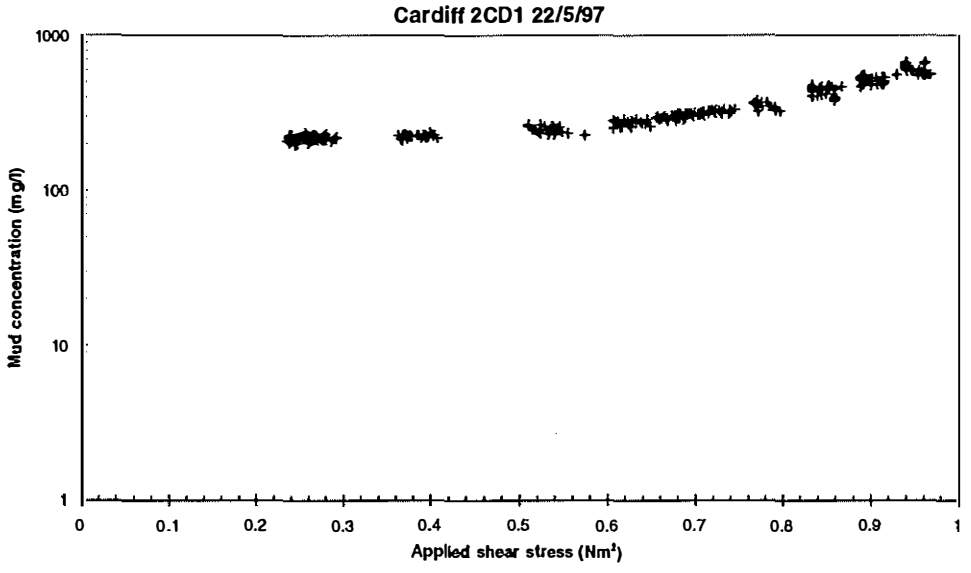


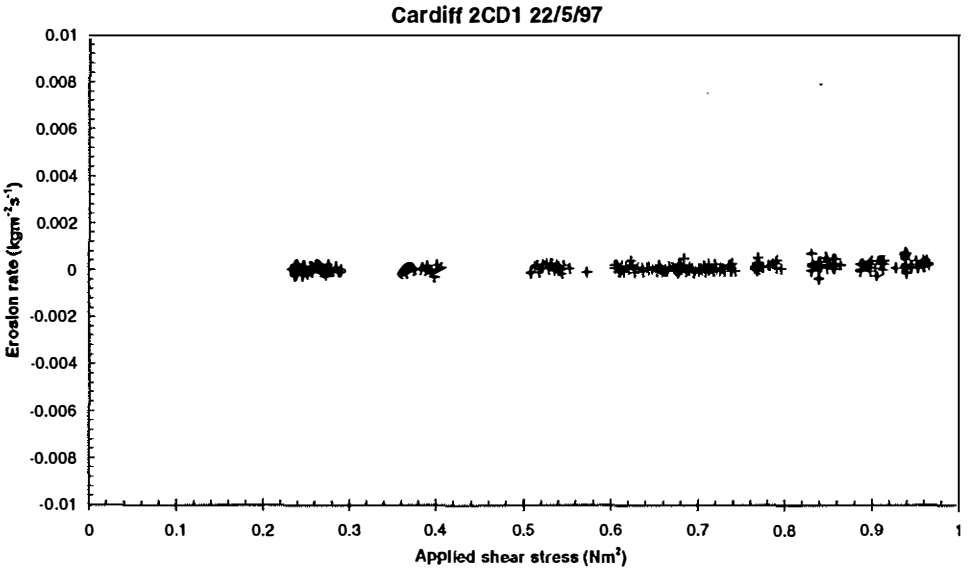

**Site:** **Cardiff seasonal survey May 1997**
Time: 15:20
Date: 22/05/97
Operator: H.J.Mitchener

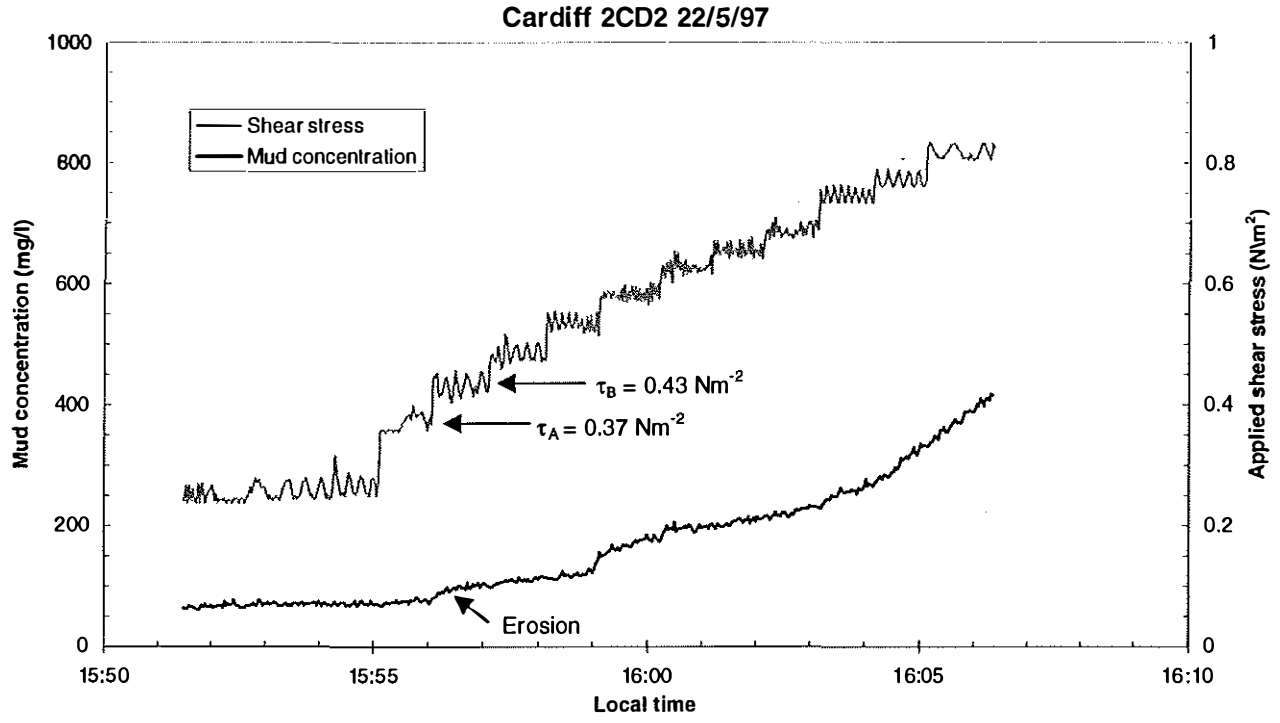
**Photographs:** Film: 1
Number: 20 Before erosion




Cardiff 2CD1 22/5/97
Mud concentration (mg/l)
1000
600
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2CD1 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2CD1 22/5/97
Erosion rate (kgm⁻²s⁻¹)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)




**Site:** **Cardiff seasonal survey May 1997**
Time: 15:47
Date: 22/05/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay008.l01

**Site description:**

| | |
|---|---|
| texture: | medium/hard on ridge |
| colour: | mid brown |
| covering: | worm pits |
| topography: | ± 1mm |
| biologically activity: | worm holes, no hydrobia or algae |
| composition: | clay/silt, homogeneous |
| other features: | on ridge approx 10cm above a drainage runnel. Stiffer outcrop |

**Surface sample:** (from top 5mm) - SM23

| | | |
|---|---|---|
| Water content: | 165 | % of dry weight |
| Bulk density: | 1313 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 9.70 | % by weight |
| Median size d50: | 2.9 | microns |
| Sand content: | 1.4 | % by weight |
| Silt content: | 57.0 | % by weight |
| Clay content: | 41.6 | % by weight |
| Mud Temperature: | 10.9 | $^0C$ |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.2, 1.0, 1.1, 1.1, 1.1
Average: 1.1

**Eroding Water:** (local collected at HW)
Salinity : 20.36

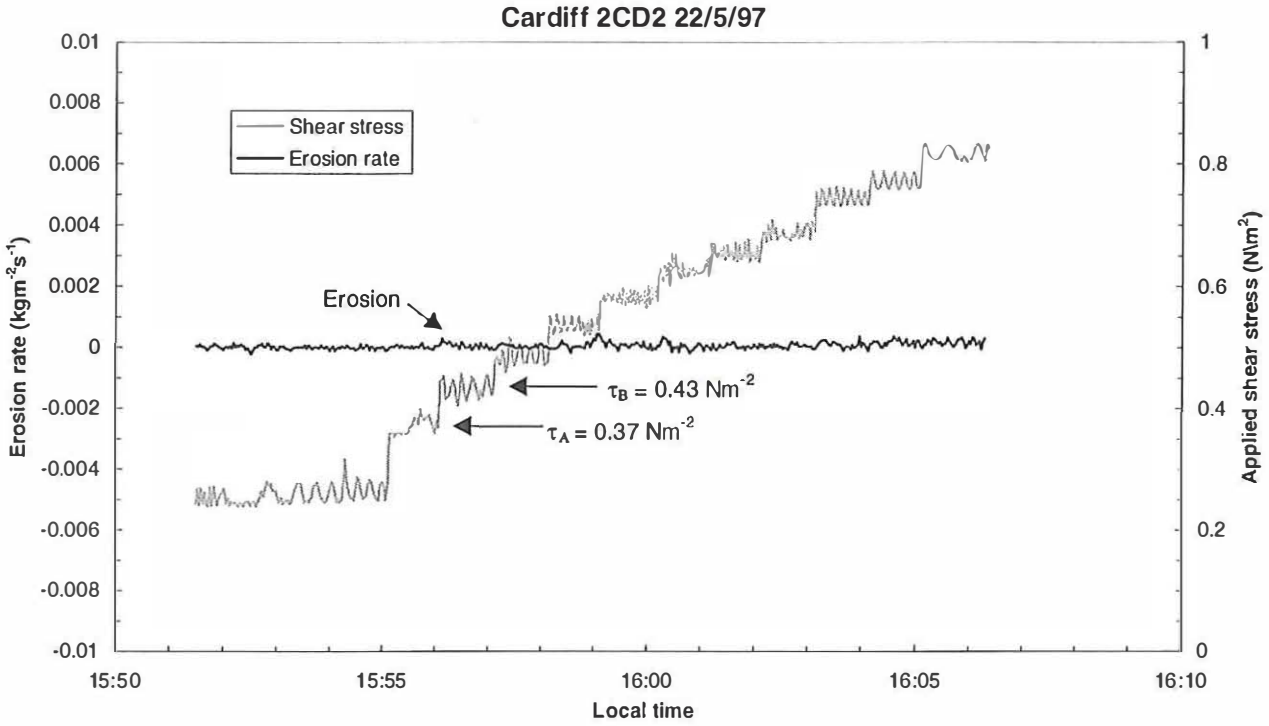
**Photographs:**

| | | |
|---|---|---|
| Film: | 1 | |
| Number: | 21 | Before erosion |
| Number: | 23 | After erosion |

**Comments:**

**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

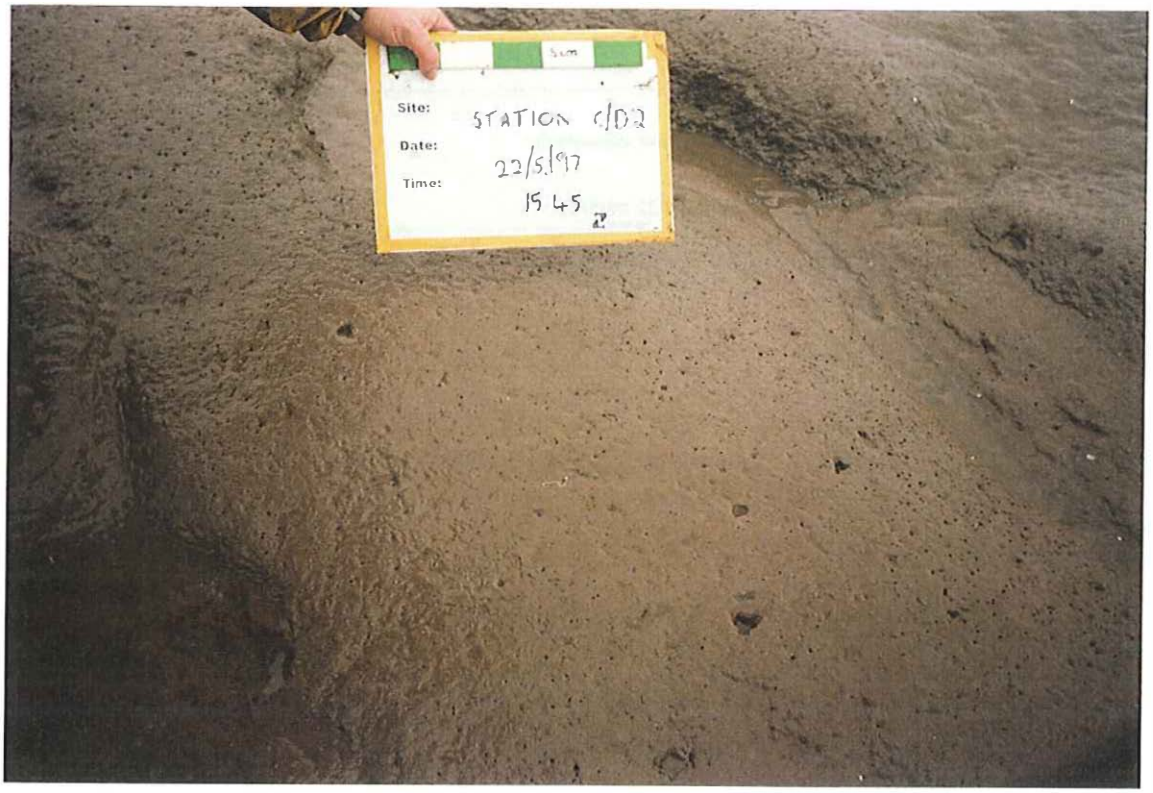
| | | |
|---|---|---|
| $\tau_A$ = | 0.37 | $Nm^{-2}$ |
| $\tau_B$ = | 0.43 | $Nm^{-2}$ |
| **Average =** | 0.40 | $Nm^{-2}$ |

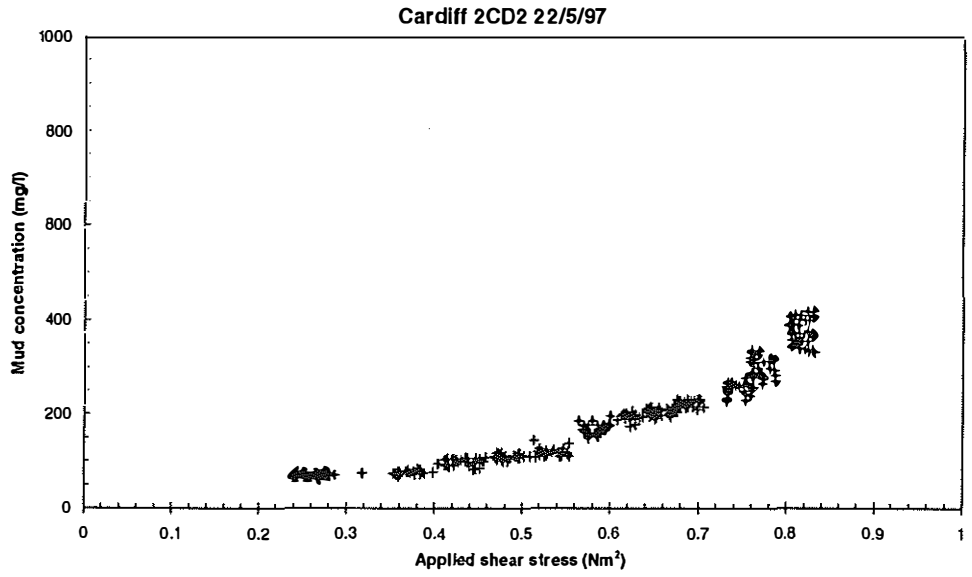


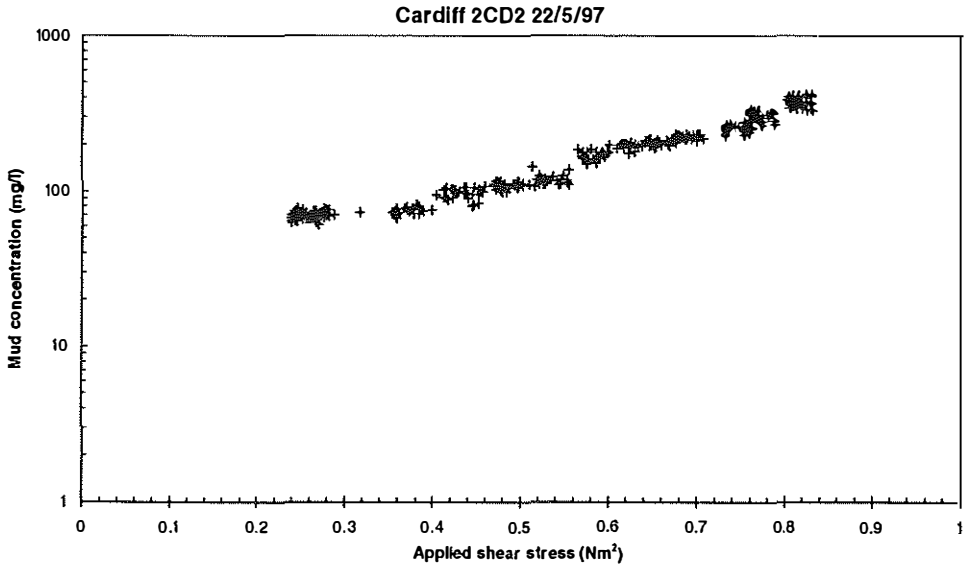

**Site:** **Cardiff seasonal survey May 1997**
Time: 15:47
Date: 22/05/97
Operator: H.J.Mitchener

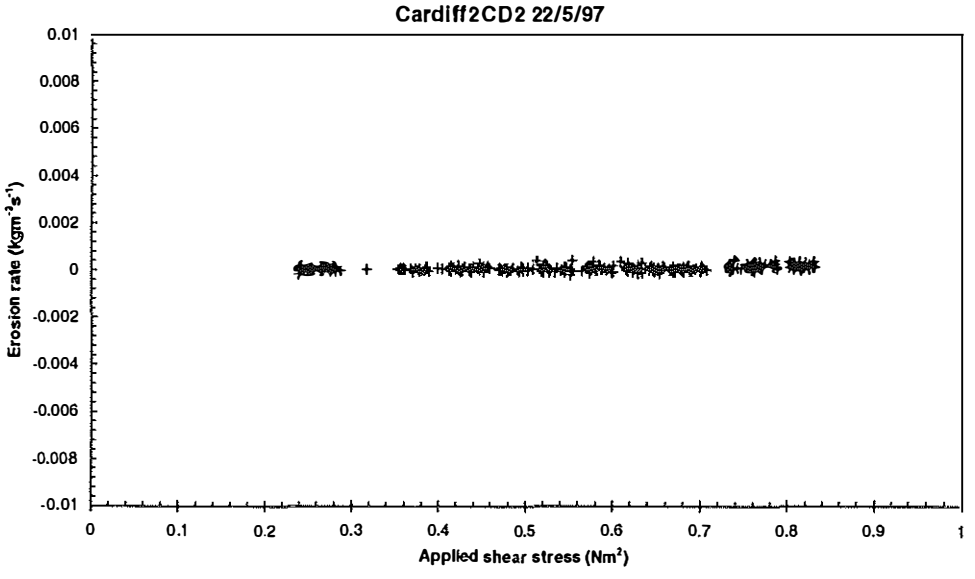
**Photographs:**

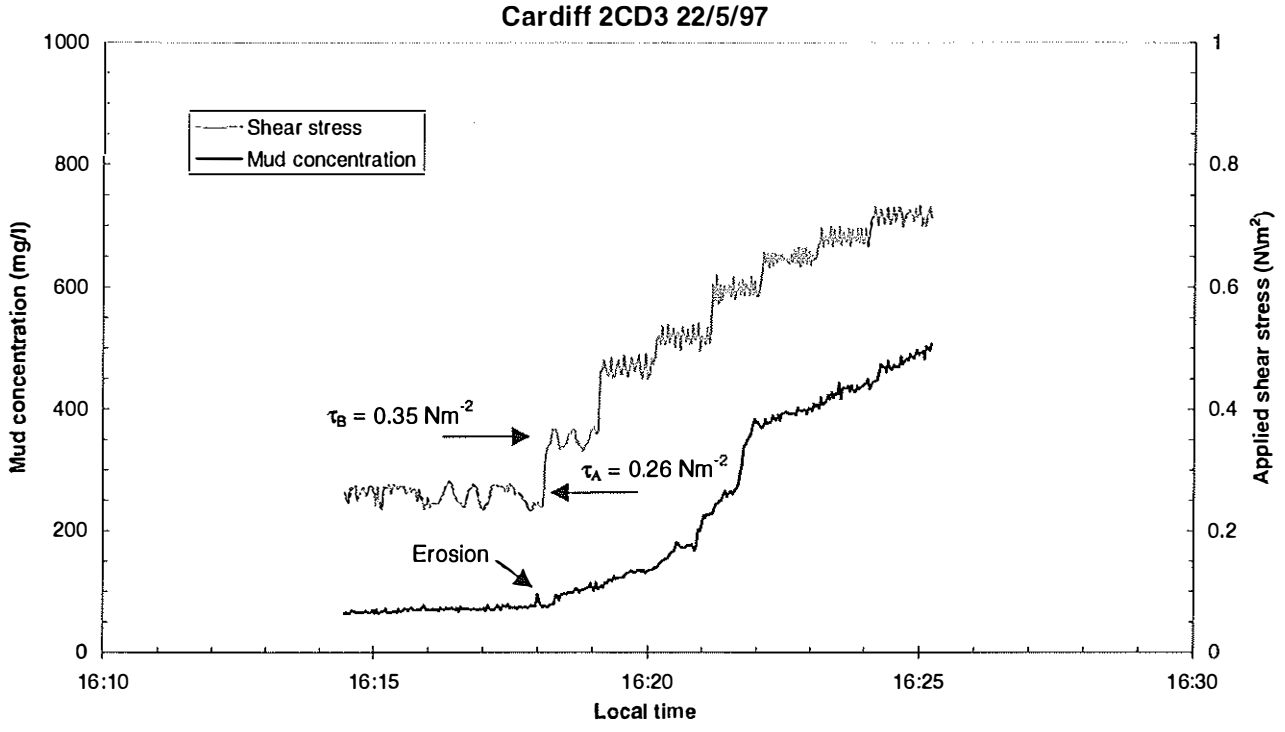
| | | |
|---|---|---|
| Film: | 1 | |
| Number: | 21 | Before erosion |
| Number: | 23 | After erosion |




Cardiff 2CD2 22/5/97
Mud concentration (mg/l)
1000
800
800
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2CD2 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff2CD2 22/5/97
Erosion rate (kgm⁻²s⁻¹)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)




**Site:** **Cardiff seasonal survey May 1997**
Time: 16:11
Date: 22/05/97
Operator: H.J.Mitchener

Data **file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cmay\cmay009.l01

**Site description:**
texture: medium/hard on ridge
colour: mid brown
covering: worm pits
topography: ± 1mm
biologically activity: worm holes, no hydrobia or algae
composition: clay/silt, homogeneous
other features: on ridge approx 1m upshore from CD2

**Surface sample:** (from top 5mm) - SM26

| | | |
|---|---|---|
| Water content: | 152 | % of dry weight |
| Bulk density: | 1332 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 9.55 | % by weight |
| Median size d50: | 2.7 | microns |
| Sand content: | 0.7 | % by weight |
| Silt content: | 55.4 | % by weight |
| Clay content: | 43.9 | % by weight |
| Mud Temperature: | 10.9 | $^0C$ |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.0
1.1
1.1
1.2
1.1
Average: 1.1

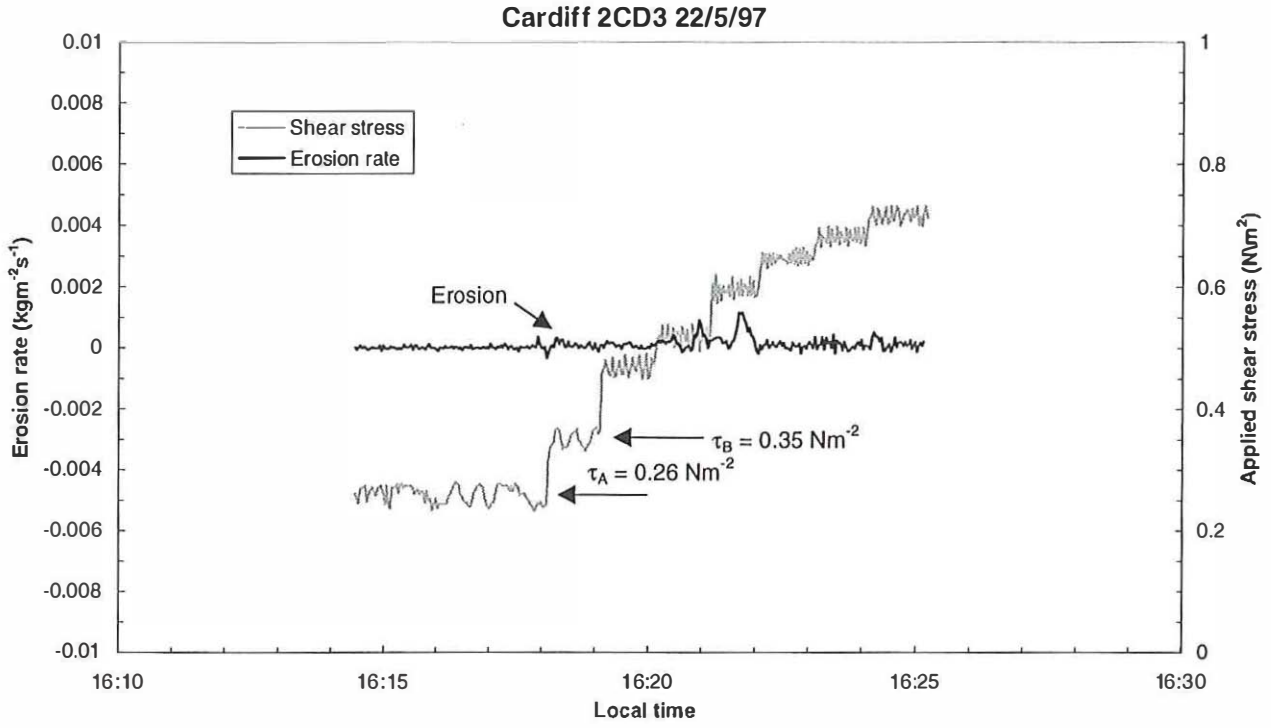
**Eroding Water:** (local collected at HW)
Salinity : 20.36

**Photographs:**
Film: 1
Number: 22 Before erosion
Number: 24 After erosion

**Comments:**

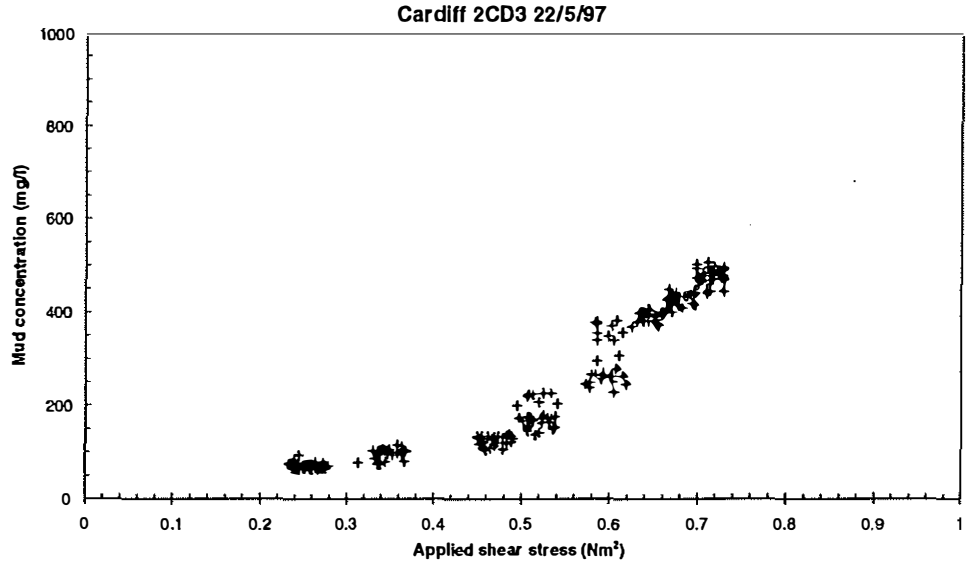
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

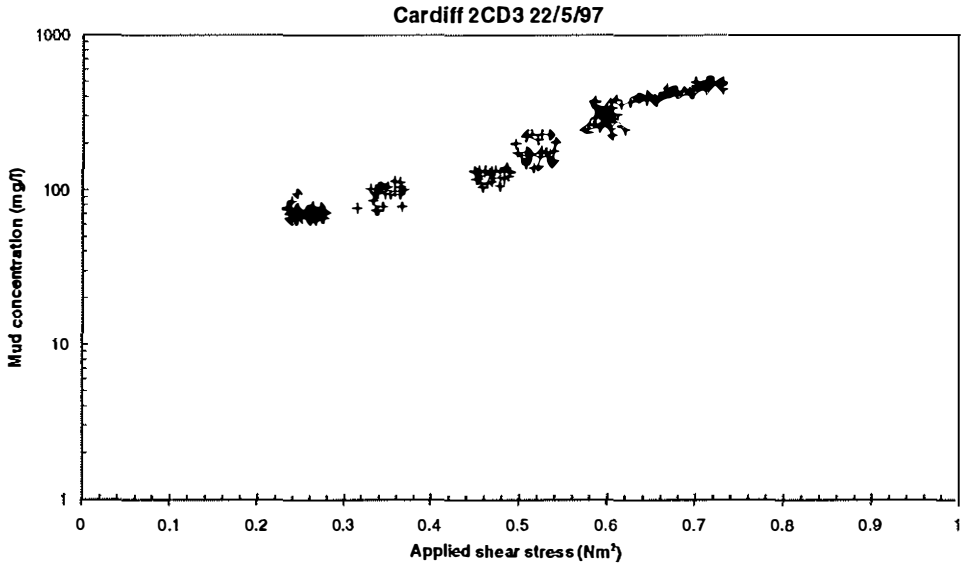
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.26** | **$Nm^{-2}$** |
| **$\tau_B$ =** | **0.35** | **$Nm^{-2}$** |
| **Average =** | **0.30** | **$Nm^{-2}$** |

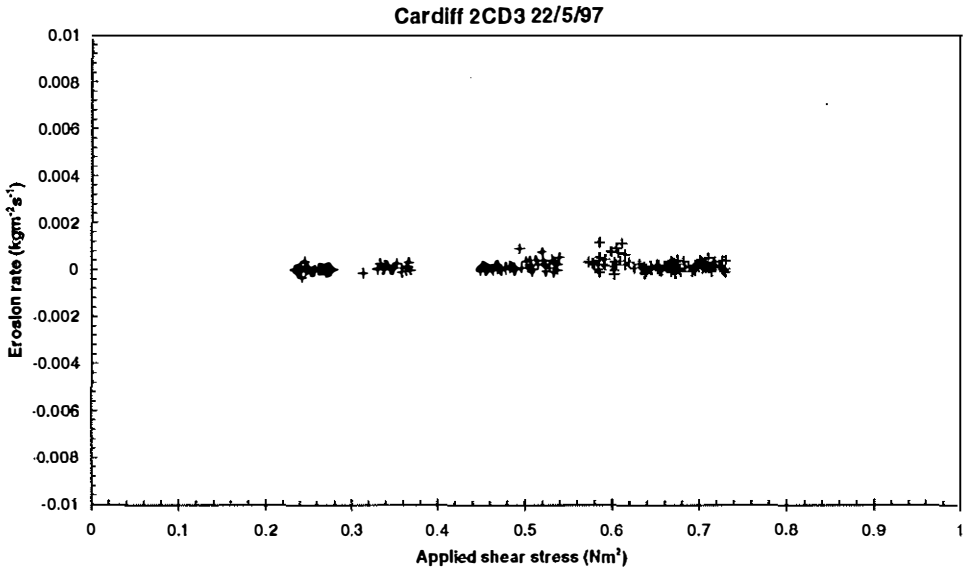



**Site:** **Cardiff seasonal survey May 1997**
Time: 16:11
Date: 22/05/97
Operator: H.J.Mitchener

**Photographs:**
Film: 1
Number: 22 Before erosion
Number: 24

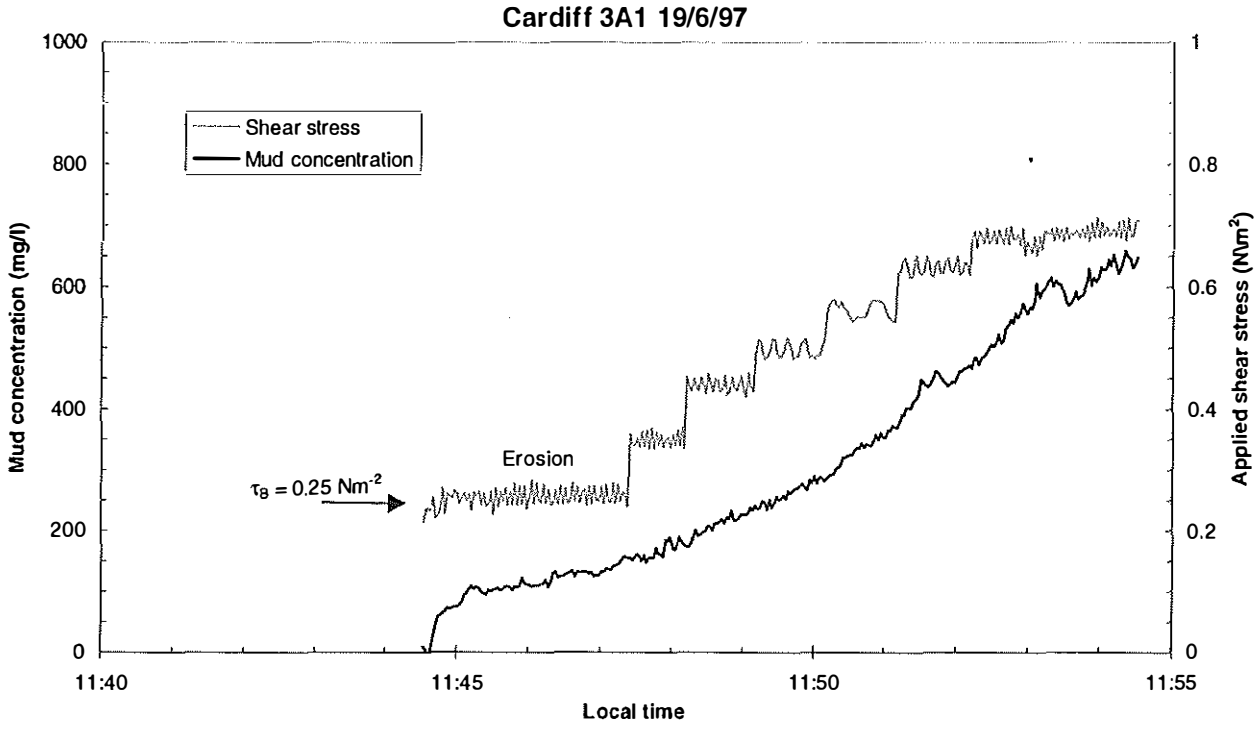

Cardiff 2CD3 22/5/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2CD3 22/5/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 2CD3 22/5/97
Erosion rate (kgm⁻²s⁻¹)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm²)

# SedErode Data Plots

## Cardiff June 1997




**Site:** **Cardiff seasonal survey June 1997**
Time: 11:32
Date: 19/06/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjun\cjun001.l01

**Site description:**
texture: medium
colour: mid brown
covering: water, as raining, pitted
topography: ±1-2mm
biologically activity: very little, no worm holes
composition: rainy, clay, scant sand
other features: Rainy and windy

**Surface sample:** (from top 5mm) - SM1-3

| | | |
|---|---|---|
| Water content: | 209 | % of dry weight |
| Bulk density: | 1260 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 8.08 | % by weight |
| Median size d50: | 2.9 | microns |
| Sand content: | 1.2 | % by weight |
| Silt content: | 60.3 | % by weight |
| Clay content: | 38.5 | % by weight |
| Mud Temperature: | 14.5 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.7
0.8
0.9
1.0
1.1
Average: 0.9

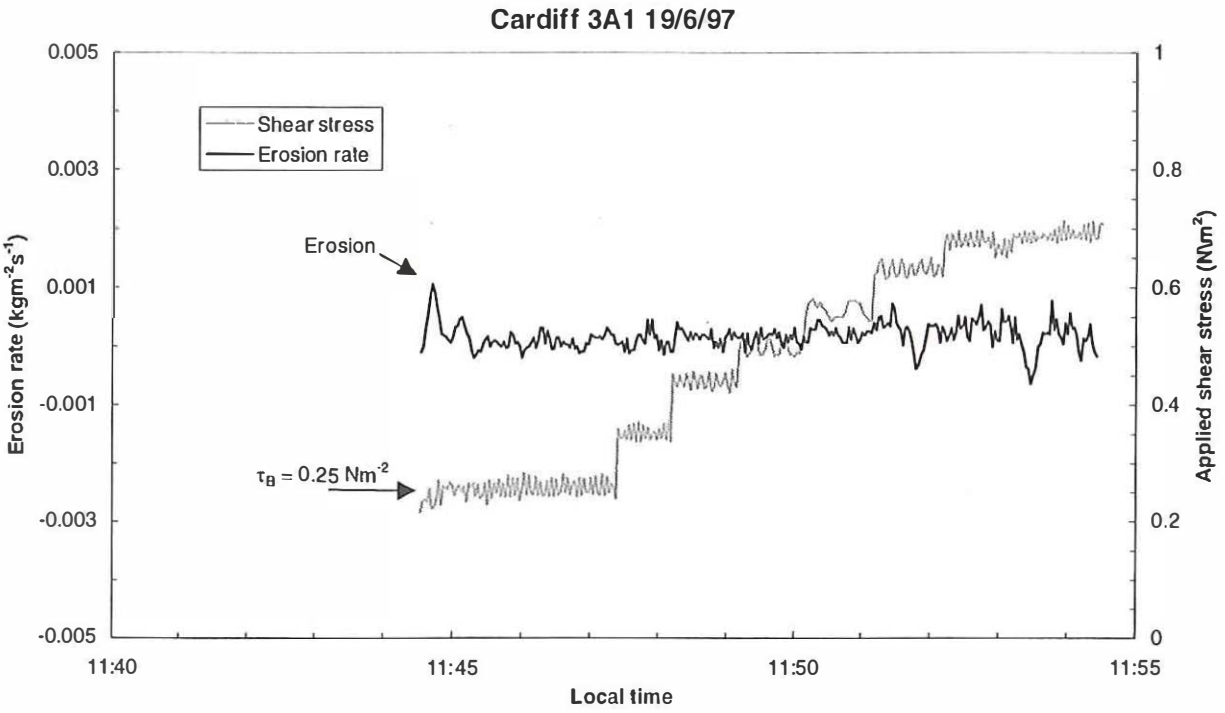
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 11:30 Number: 2 Before erosion

**Comments:**

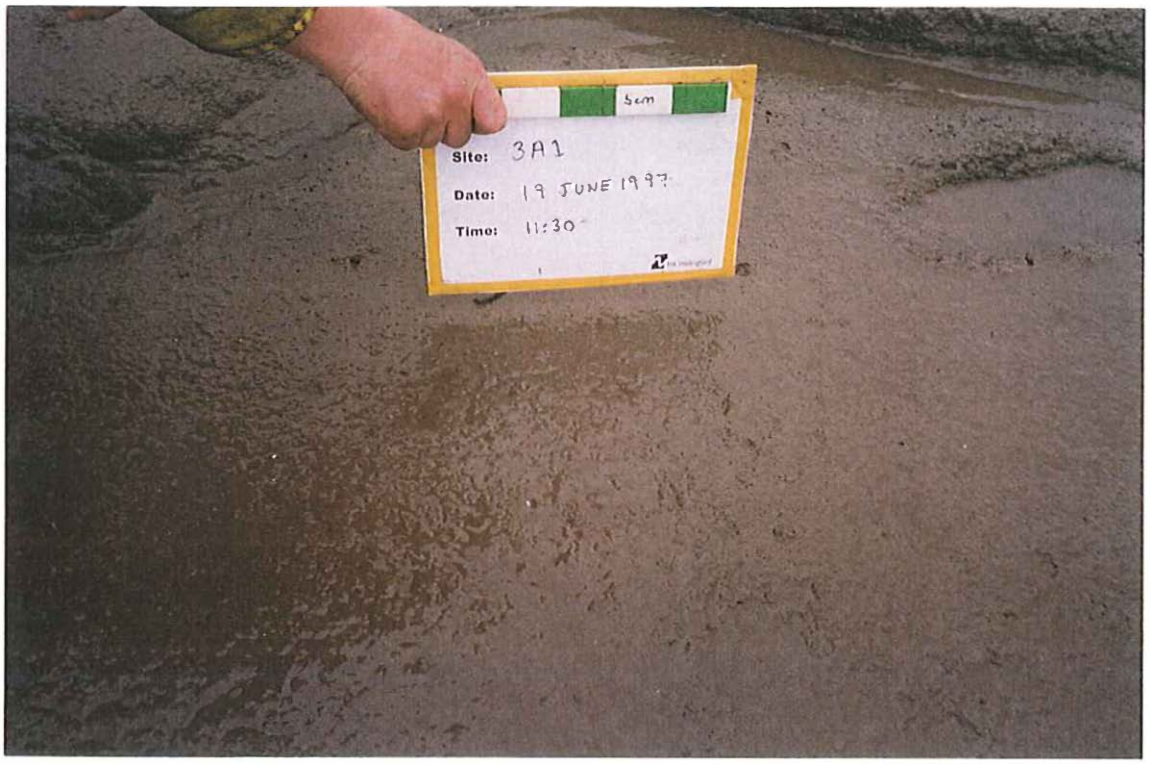
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

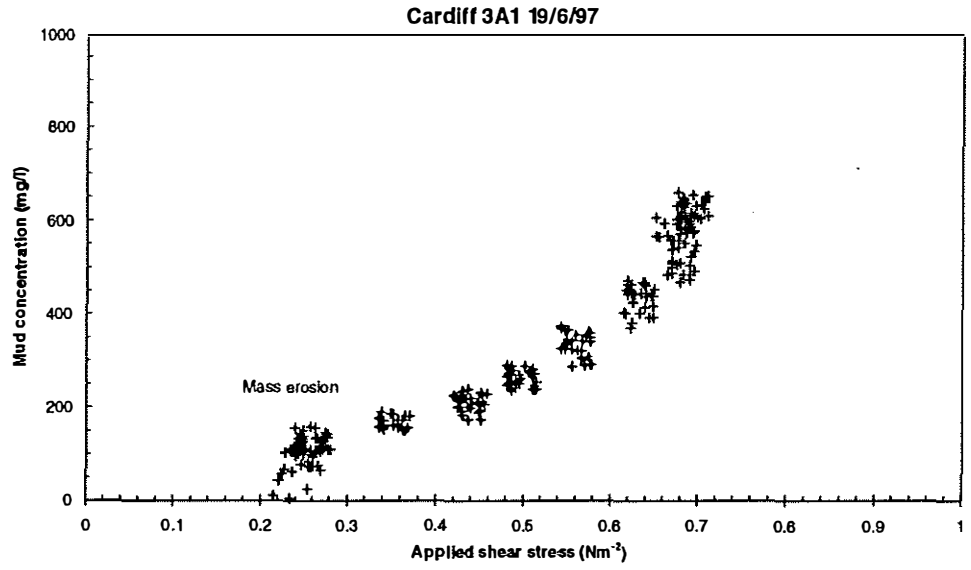
| | | |
|---|---|---|
| $\tau_A$ = | 0.00 | Nm$^{-2}$ |
| $\tau_B$ = | 0.25 | Nm$^{-2}$ |
| Average = | 0.13 | Nm$^{-2}$ |

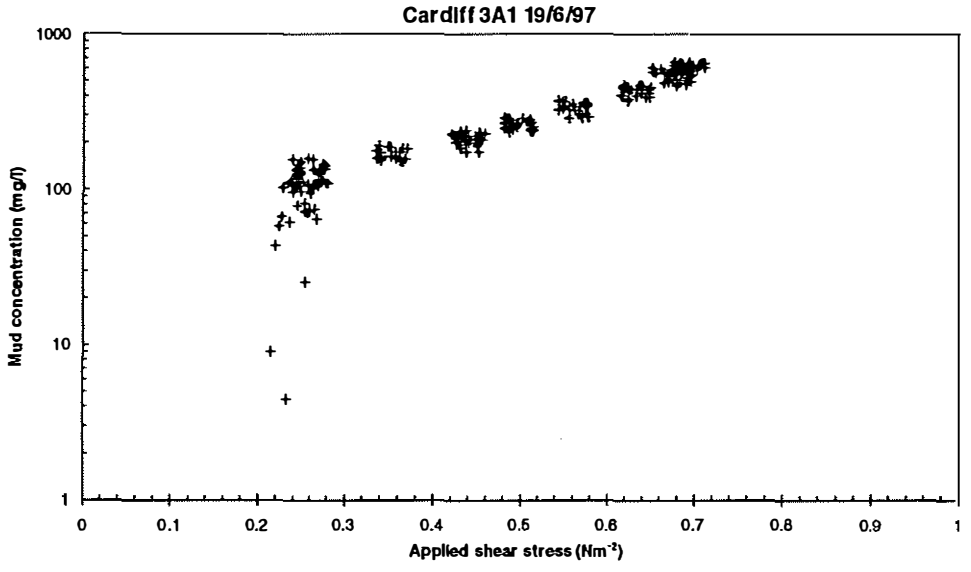


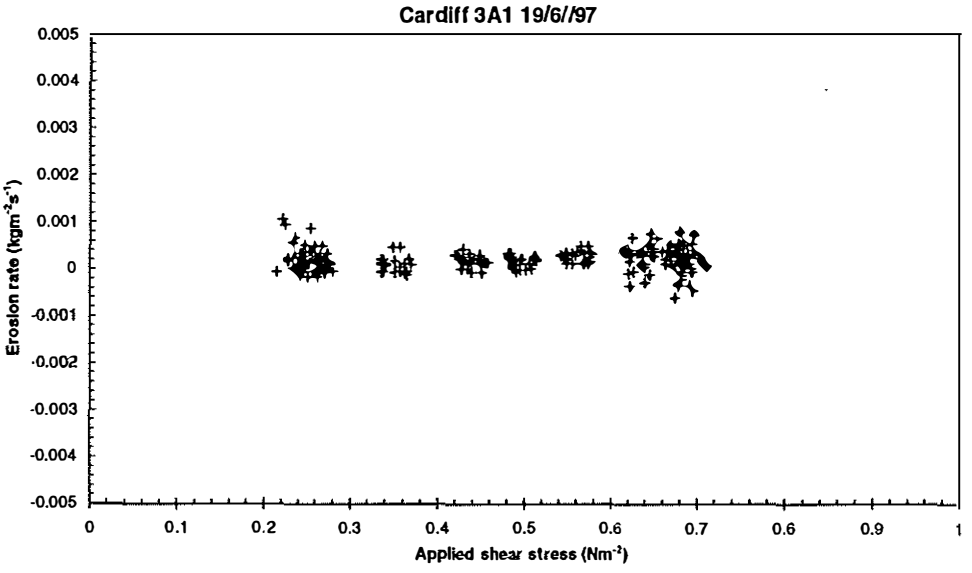

**Site:** **Cardiff seasonal survey June 1997**
Time: 11:32
Date: 19/06/97
Operator: H.J.Mitchener

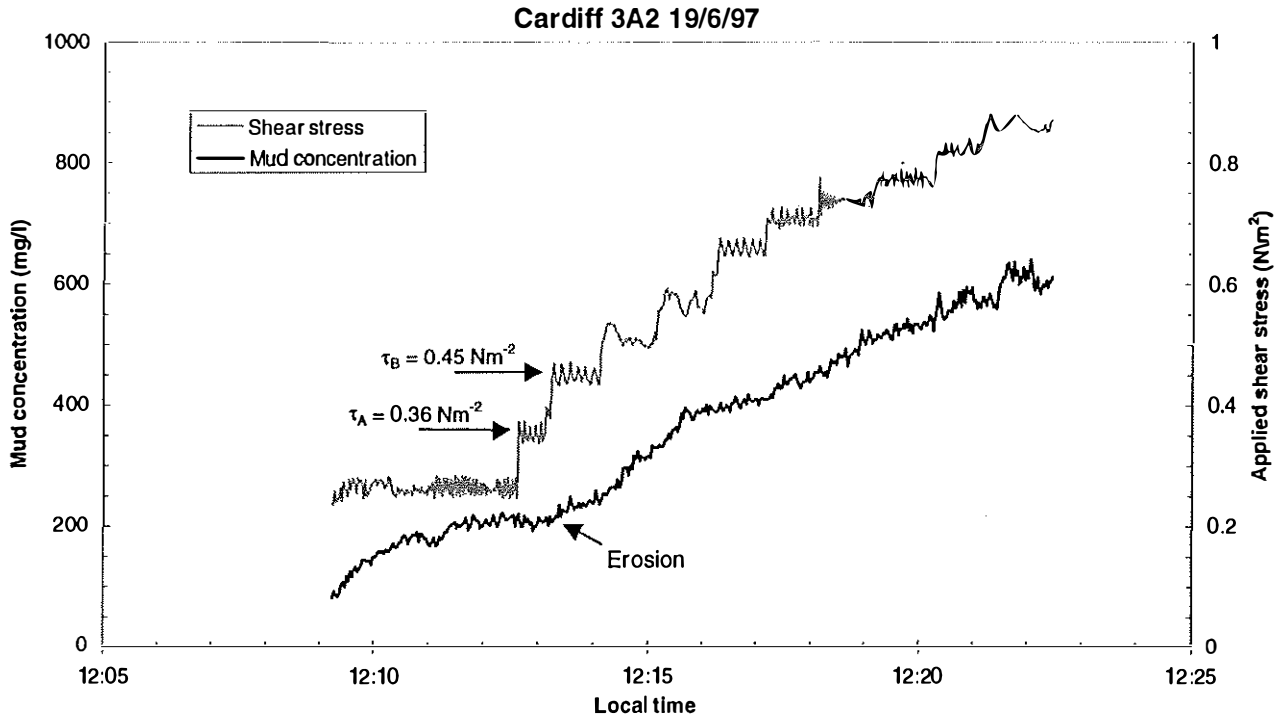
**Photographs:** Film: 1
Time 11:30 Number: 2 Before erosion




Cardiff 3A1 19/6/97
Mud concentration (mg/l)
Mass erosion
Applied shear stress (Nm-2)


Cardiff 3A1 19/6/97
Mud concentration (mg/l)
Applied shear stress (Nm-2)


Cardiff 3A1 19/6//97
Erosion rate (kgm-2s-1)
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey June 1997**
Time: 12:06
Date: 19/06/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjun\cjun002.l01

**Site description:**
texture: medium
colour: mid brown
covering: fluidised with rain
topography: ±1-2mm
biologically activity: very little, no worm holes
composition: rainy, clay, scant sand
other features: Heavy rain and windy, 0.5 m from channel

**Surface sample:** (from top 5mm) - SM4-6

| | | |
|---|---|---|
| Water content: | 223 | % of dry weight |
| Bulk density: | 1248 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 8.18 | % by weight |
| Median size d50: | 3.0 | microns |
| Sand content: | 2.0 | % by weight |
| Silt content: | 61.5 | % by weight |
| Clay content: | 36.5 | % by weight |
| Mud Temperature: | 14.4 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.7
0.9
0.8
0.9
1.0
Average: 0.9

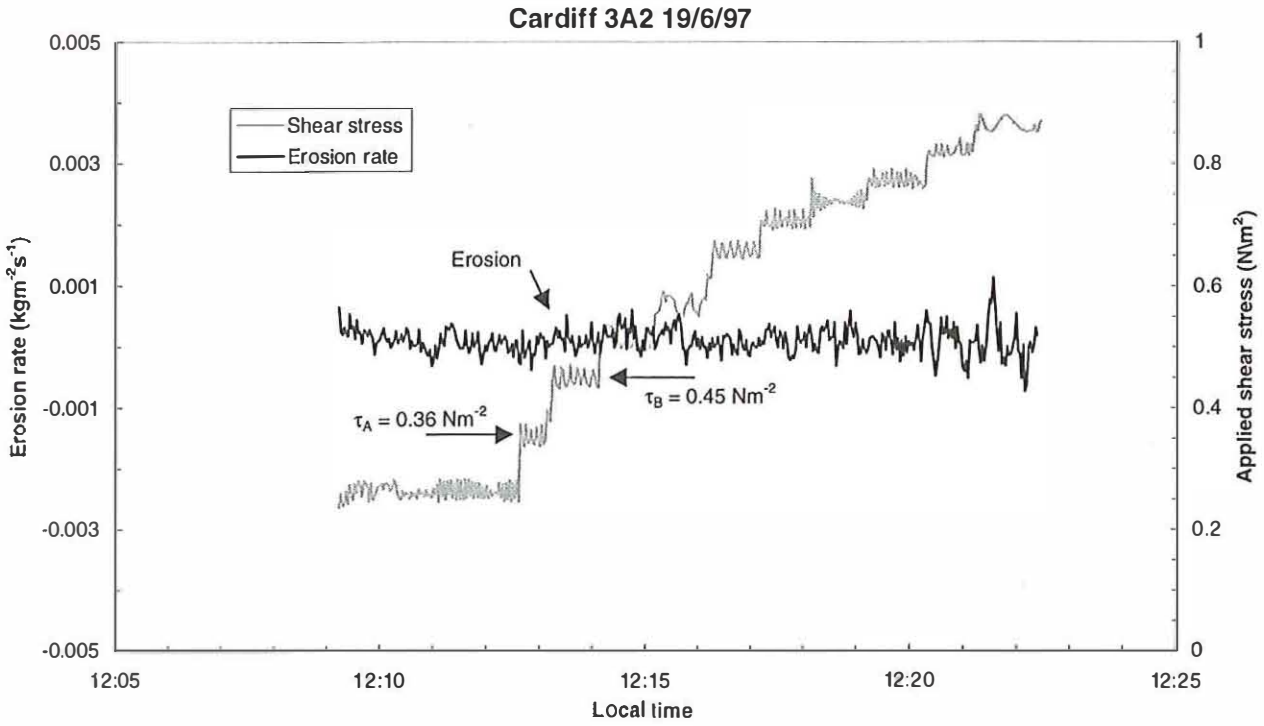
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:**
Film: 1
Time 12:04 Number: 3

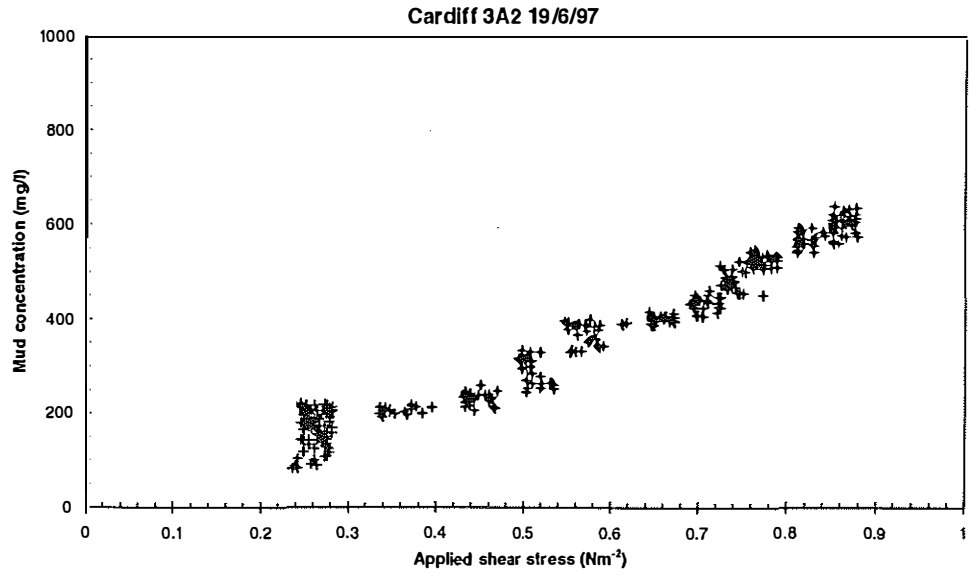
**Comments:**

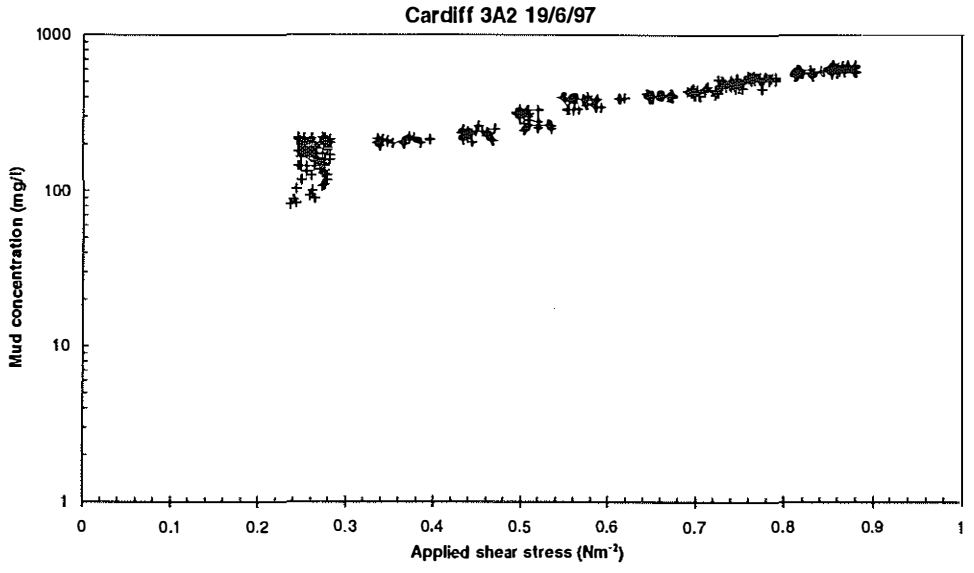
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

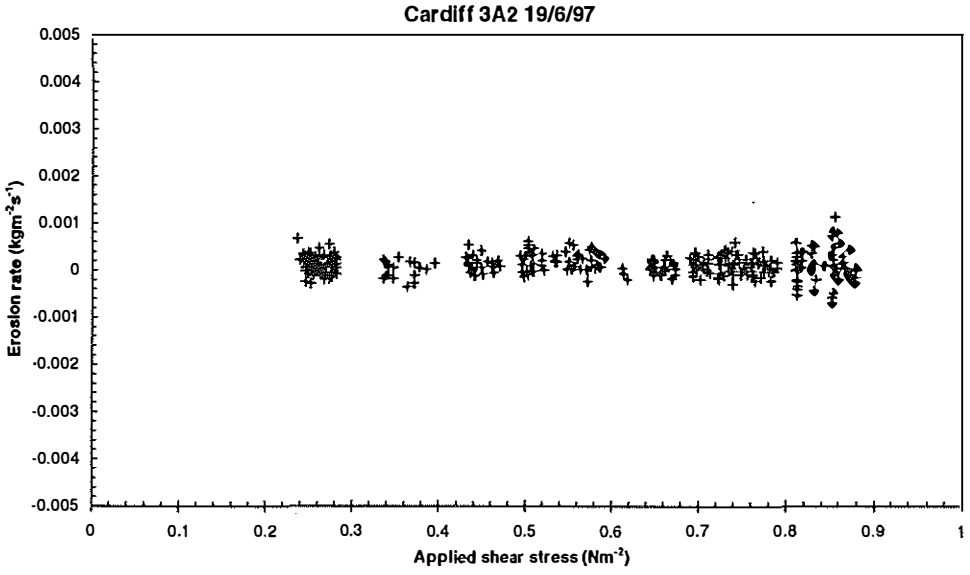
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.36** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.45** | **Nm$^{-2}$** |
| **Average =** | **0.40** | **Nm$^{-2}$** |

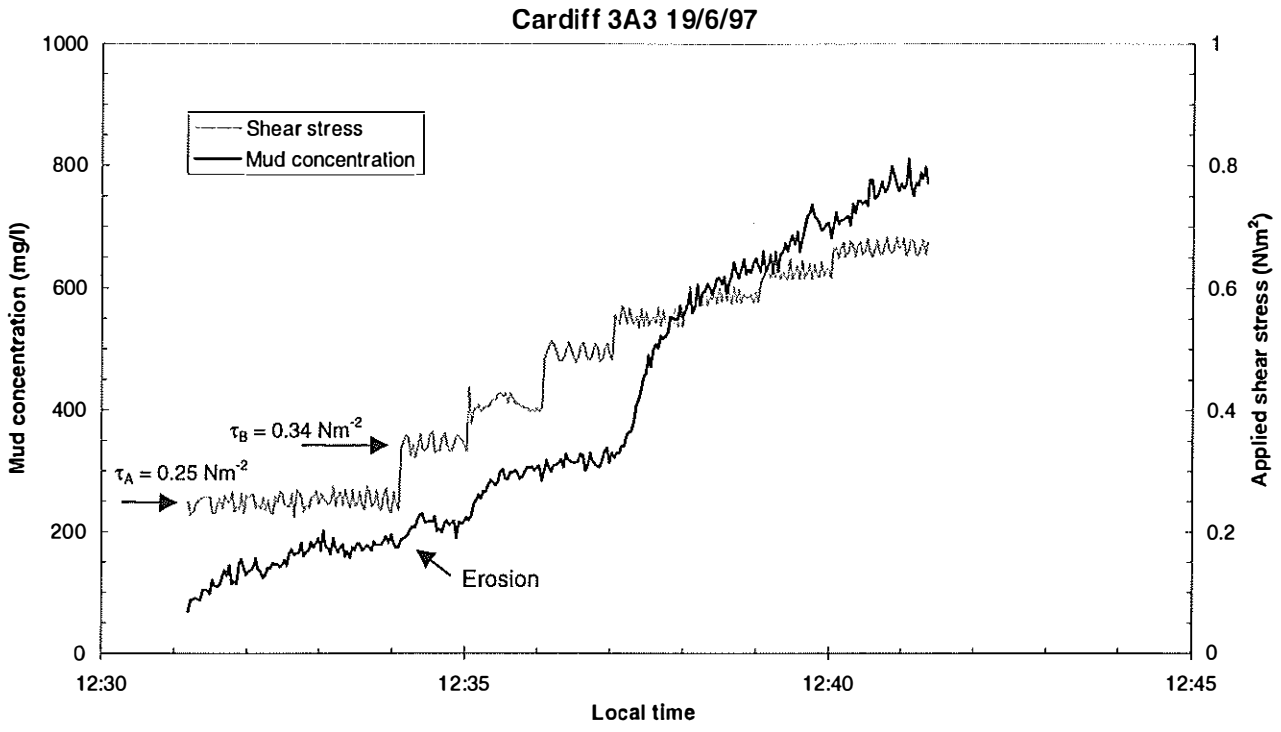



| | | | | | |
|---|---|---|---|---|---|
| **Site:** | **Cardiff seasonal survey June 1997** | **Photographs:** | | Film: | 1 |
| Time: | 12:06 | Time | 12:04 | Number: | 3 |
| Date: | 19/06/97 | | | | |
| Operator: | H.J.Mitchener | | | | |


Cardiff 3A2 19/6/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3A2 19/6/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3A2 19/6/97
Erosion rate (kgm-2s-1)
0.005
0.004
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
-0.004
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey June 1997**
Time: 12:27
Date: 19/06/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjun\cjun003.l01

**Site description:**
texture: medium
colour: mid brown
covering: fluidised and pitted with rain
topography: ±1-2mm
biologically activity: very illtle, no worm holes
composition: rainy, clay, scant sand
other features: Rainy and windy, 2m to edge of channel

**Surface sample:** (from top 5mm) - SM7-9

| | | |
|---|---|---|
| Water content: | 217 | % of dry weight |
| Bulk density: | 1254 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 8.11 | % by weight |
| Median size d50: | 3.2 | microns |
| Sand content: | 3.6 | % by weight |
| Silt content: | 55.1 | % by weight |
| Clay content: | 41.3 | % by weight |
| Mud Temperature: | 15.6 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.9
1.1
0.9
0.9
0.5
Average: 0.9

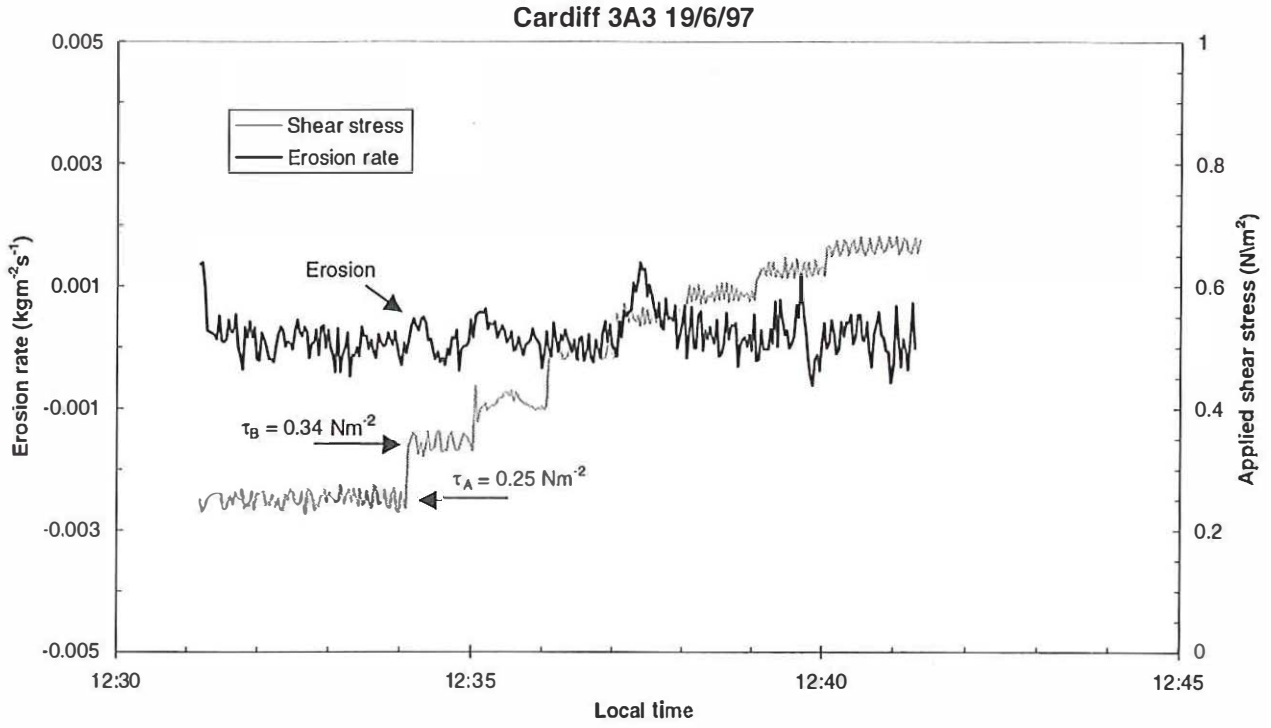
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 12:25 Number: 6

**Comments:**

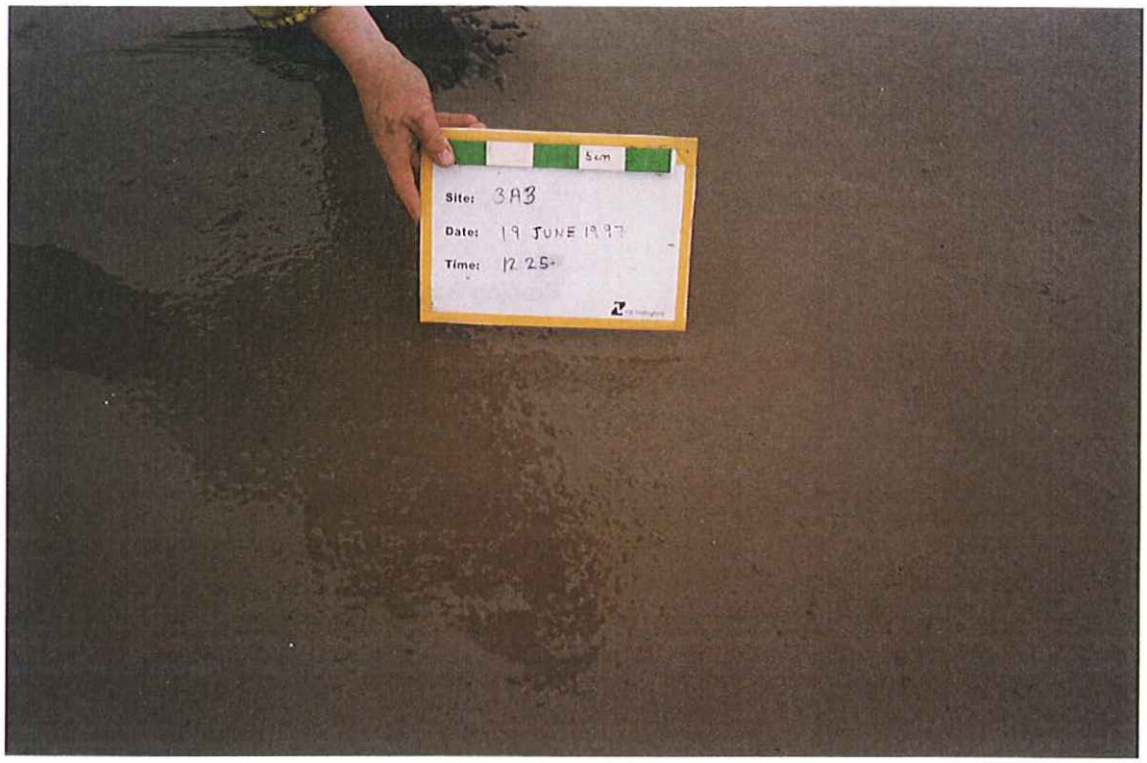
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

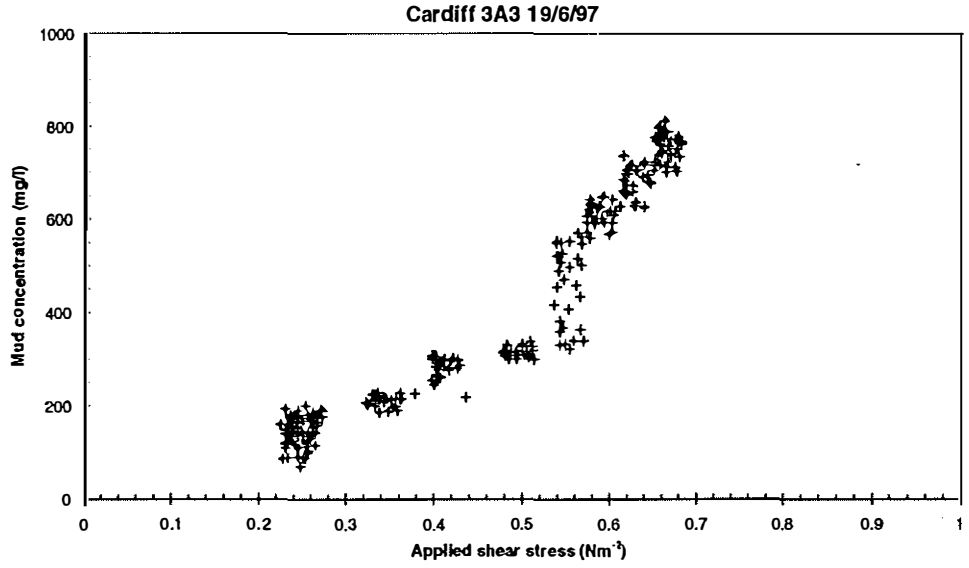
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.25** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.34** | **Nm$^{-2}$** |
| **Average =** | **0.30** | **Nm$^{-2}$** |

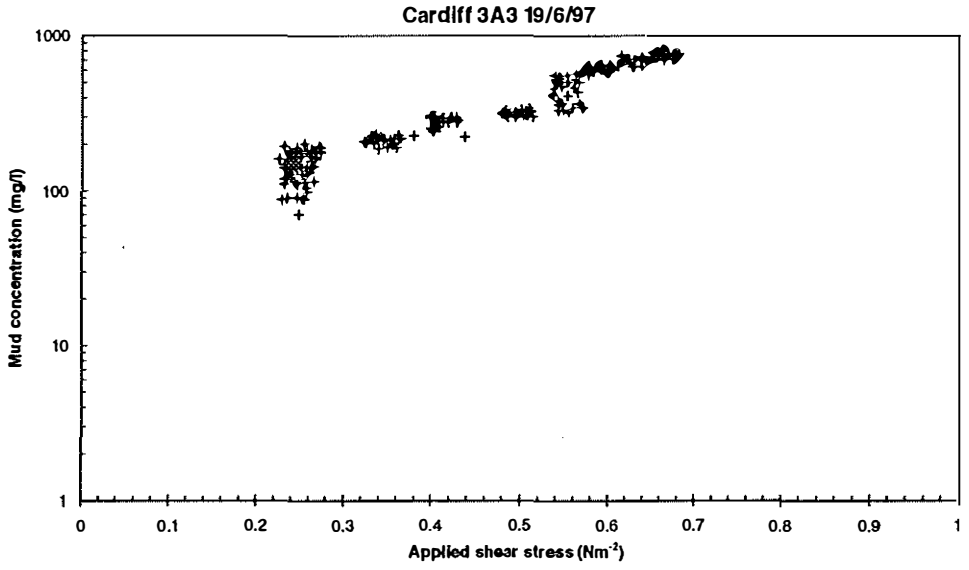


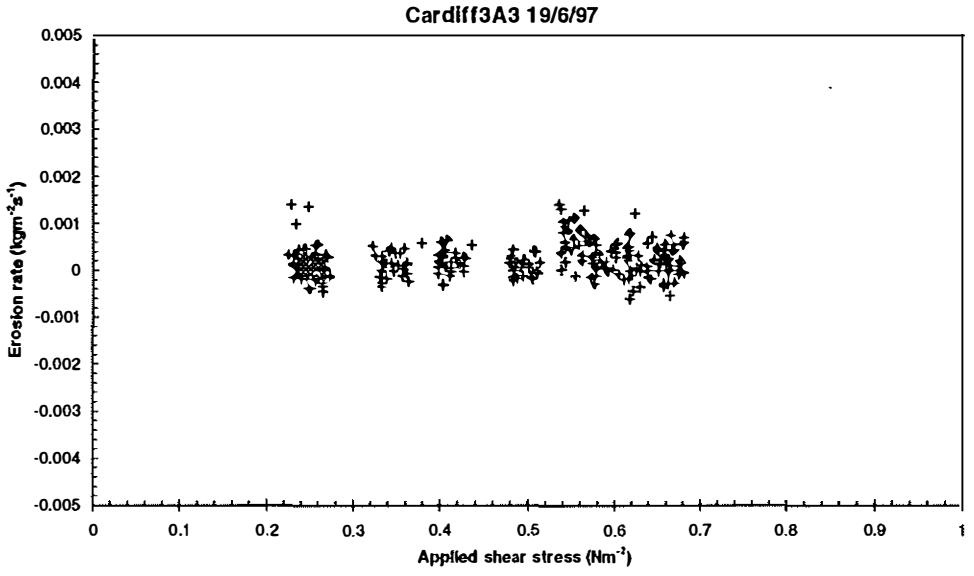

**Site:** **Cardiff seasonal survey June 1997**
Time: 12:27
Date: 19/06/97
Operator: H.J.Mitchener

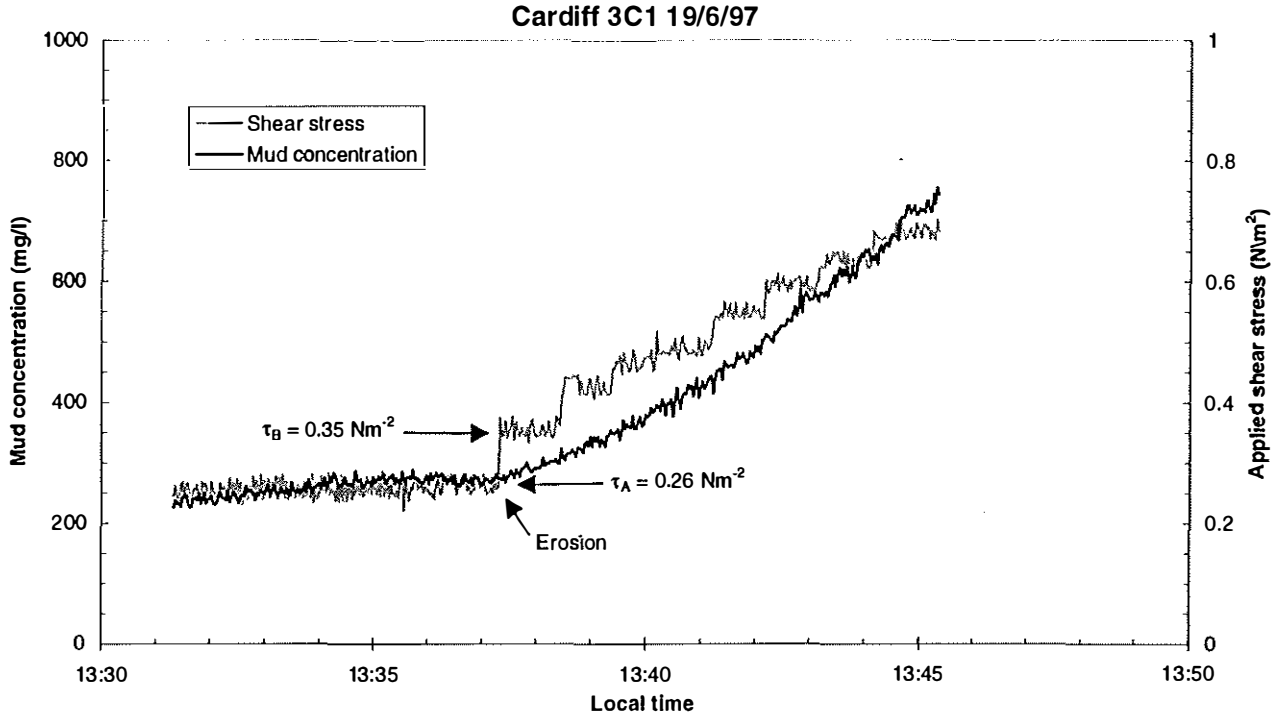
**Photographs:** Film: 1
Time 12:25 Number: 6




Cardiff 3A3 19/6/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3A3 19/6/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff3A3 19/6/97
Erosion rate (kgm-2s-1)
0.005
0.004
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
-0.004
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey June 1997**
Time: 11:25
Date: 19/06/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjun\cjun004.l01

**Site description:**
texture: medium hard gelatinous
colour: mid brown
covering: few worm holes, no hydrobia
topography: lumpy ~ ± 2mm
biologically activity: worms coming out now
composition: clay, scant sand
other features: Drainage noise. LW now.
Slight rain after 0.75 hour of dry weather.

**Surface sample:** (from top 5mm) - SM10-12

| | | |
|---|---|---|
| Water content: | 220 | % of dry weight |
| Bulk density: | 1250 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 8.65 | % by weight |
| Median size d50: | 2.3 | microns |
| Sand content: | 2.5 | % by weight |
| Silt content: | 52.9 | % by weight |
| Clay content: | 44.6 | % by weight |
| Mud Temperature: | 16.4 | $^0C$ |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.5
0.6
0.7
0.7
0.6
Average: 0.6

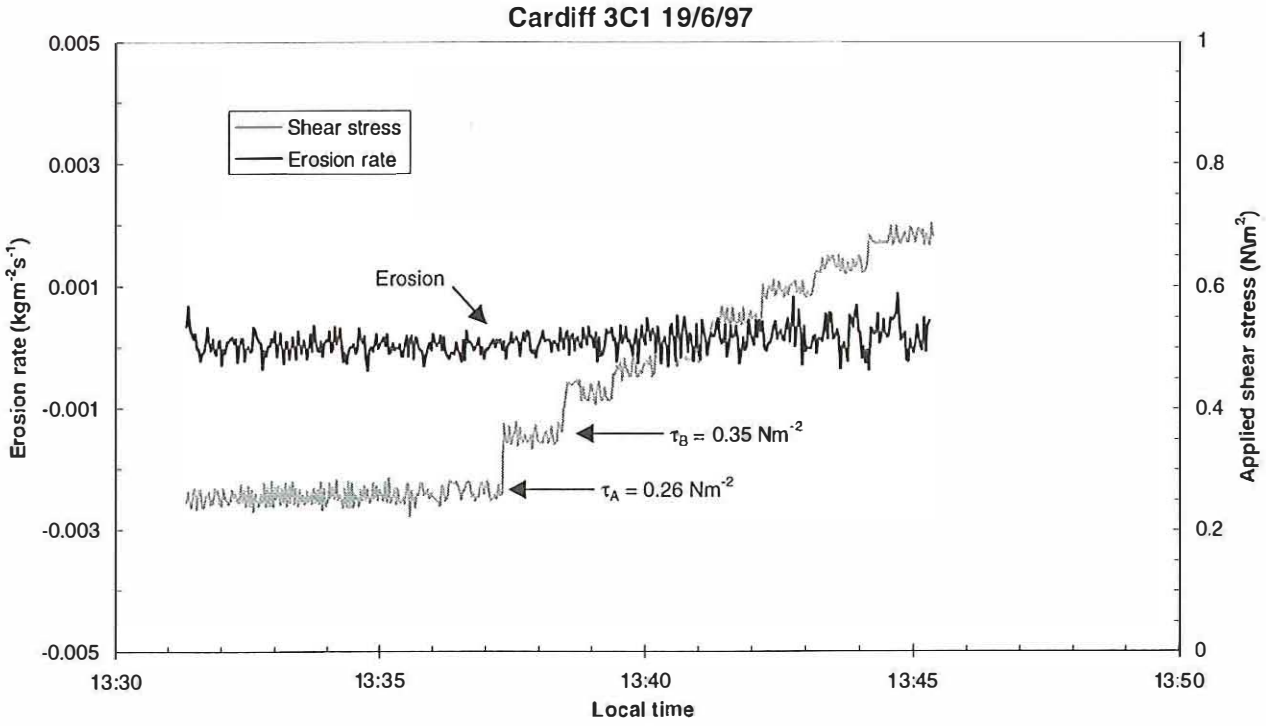
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:**
Film: 1
Time: 13:24 Number: 7

**Comments:**

**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

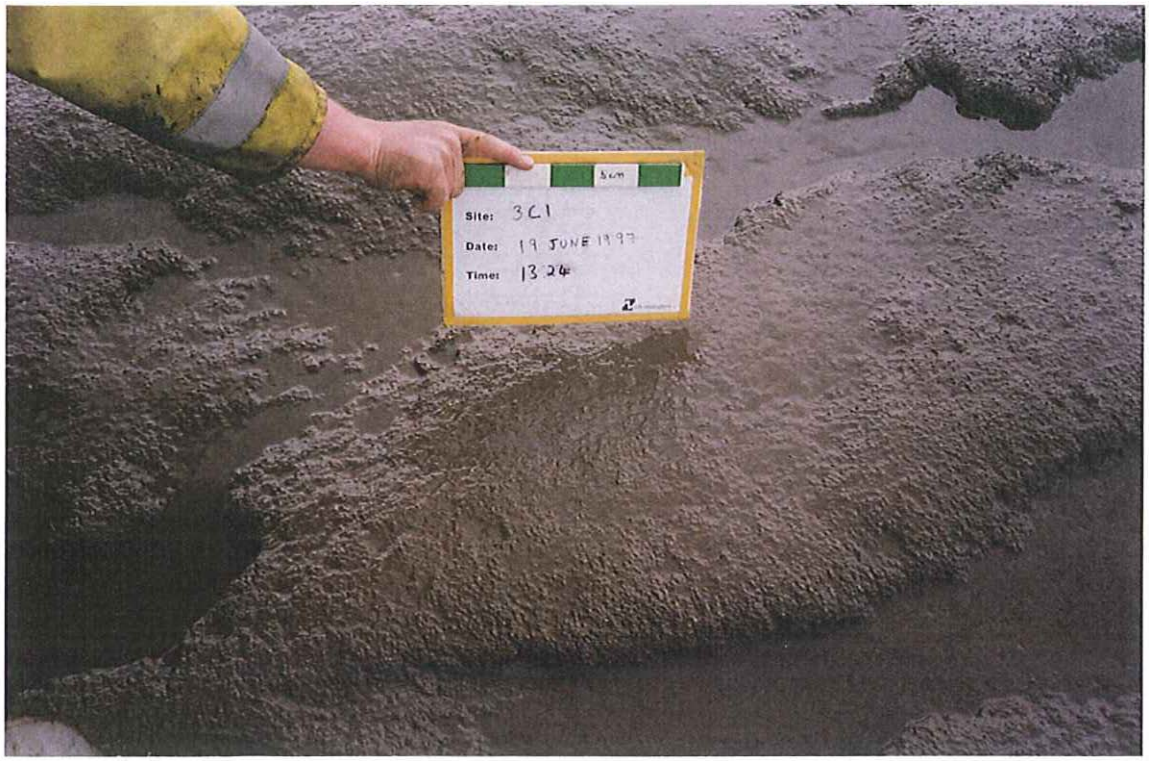
| | | |
|---|---|---|
| $\tau_A$ = | **0.26** | **$Nm^{-2}$** |
| $\tau_B$ = | **0.35** | **$Nm^{-2}$** |
| **Average =** | **0.31** | **$Nm^{-2}$** |

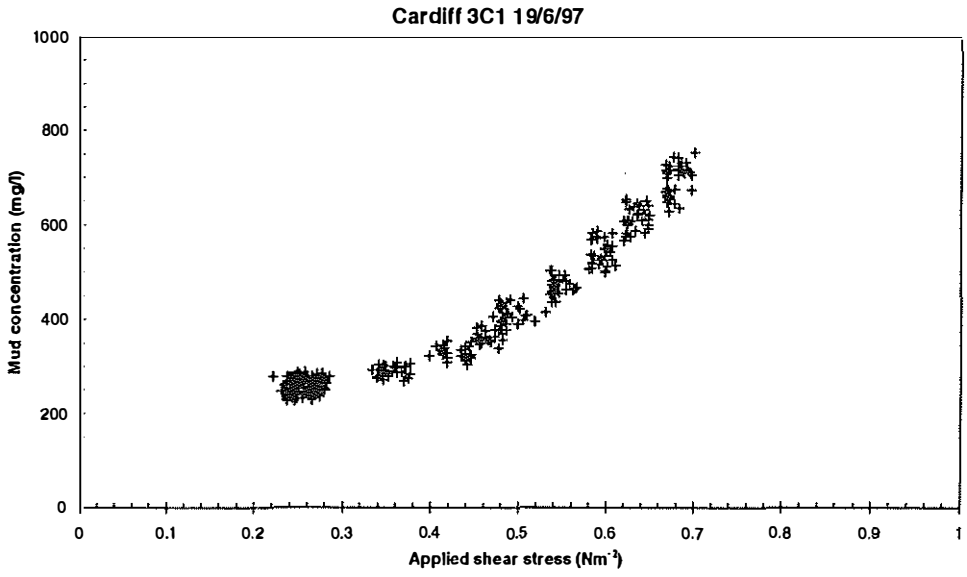


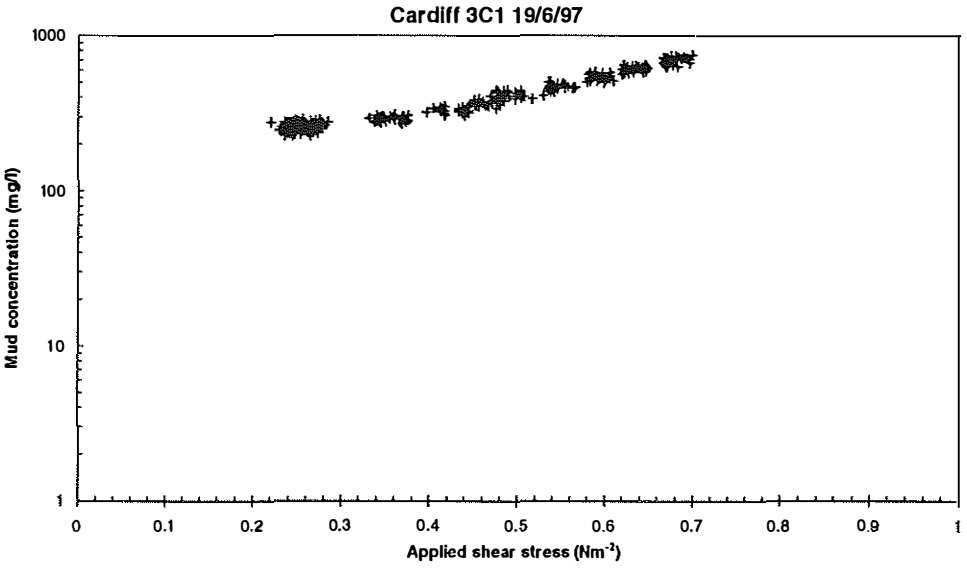

**Site:** **Cardiff seasonal survey June 1997**
Time: 11:25
Date: 19/06/97
Operator: H.J.Mitchener

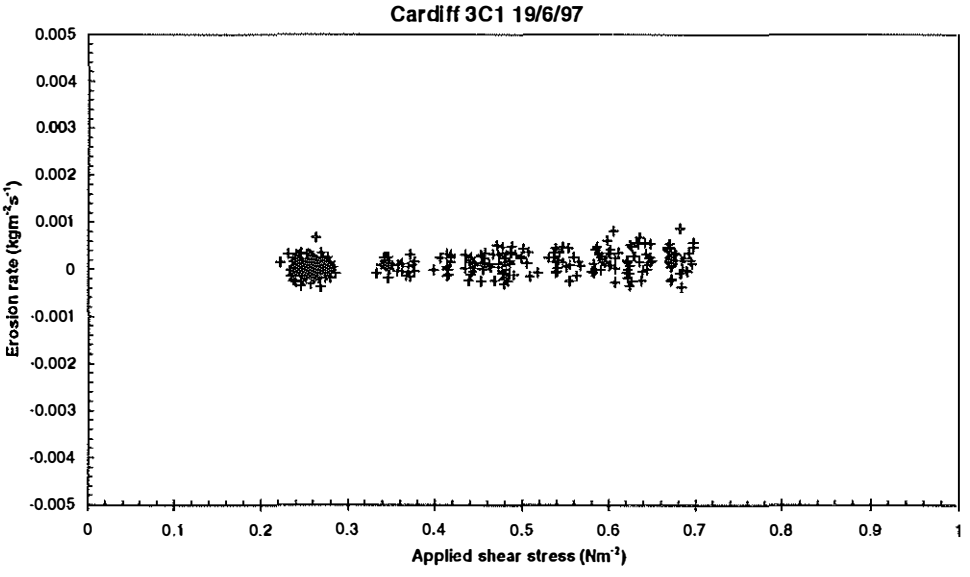
**Photographs:** Time: 13:24

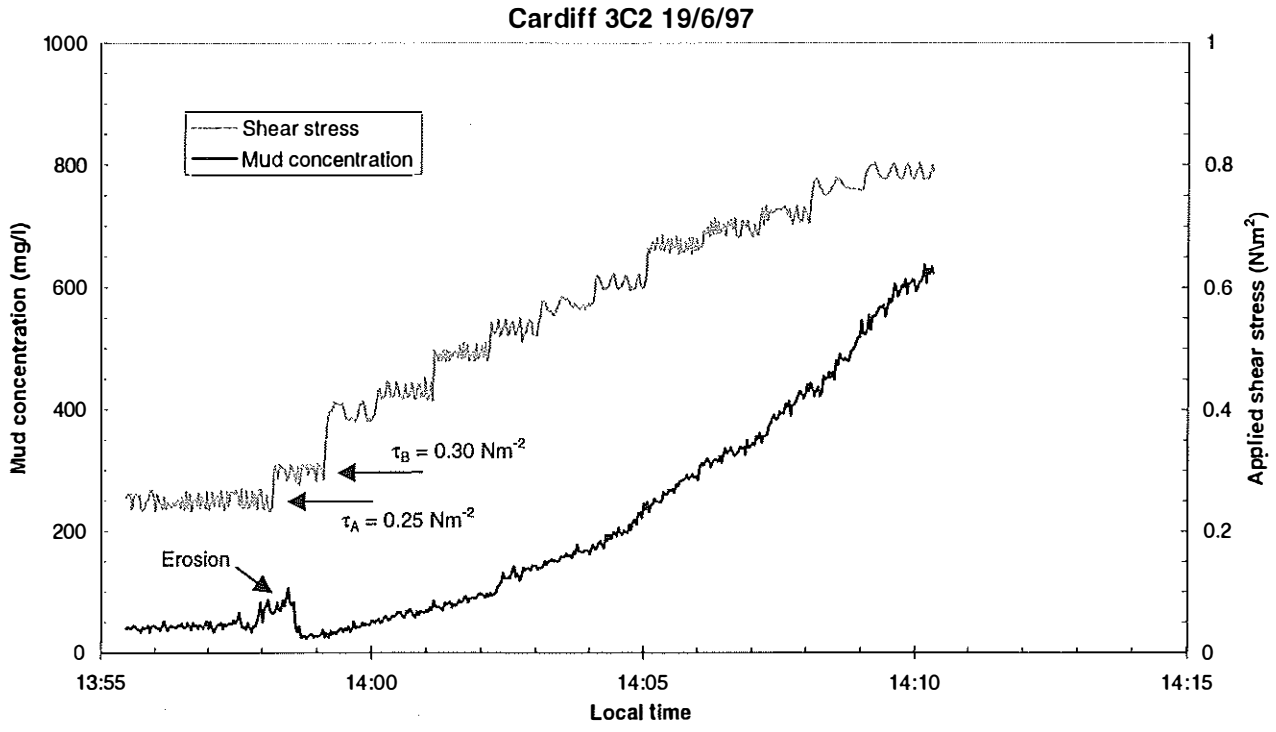
Film: 1
Number: 7




Cardiff 3C1 19/6/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3C1 19/6/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3C1 19/6/97
Erosion rate (kgm-2s-1)
0.005
0.004
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
-0.004
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey May 1997**
Time: 13:50
Date: 19/06/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjun\cjun005.l01

**Site description:**

texture: medium hard gelatinous
colour: mid brown
covering: few worm holes, no hydrobia
topography: lumpy ~ ± 2mm
biologically activity: worms coming out now
composition: clay, scant sand
other features: 0.5m to E of 3C1, midway between runnels, lumpy bed

**Surface sample:** (from top 5mm) - SM13-15

| | | |
|---|---|---|
| Water content: | 194 | % of dry weight |
| Bulk density: | 1276 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 8.66 | % by weight |
| Median size d50: | 2.4 | microns |
| Sand content: | 1.9 | % by weight |
| Silt content: | 54.7 | % by weight |
| Clay content: | 43.4 | % by weight |
| Mud Temperature: | 17.3 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.7
0.5
0.7
0.5
0.6
Average: 0.6

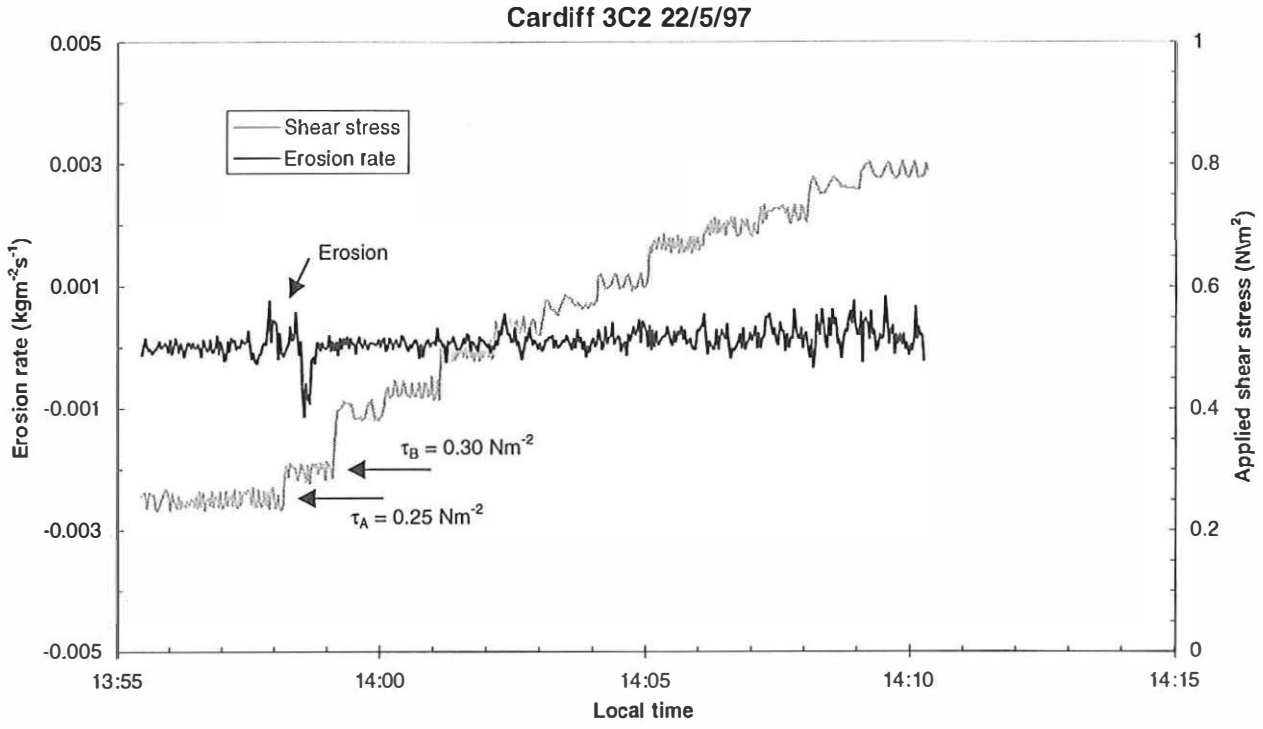
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 13:48 Number: 8

**Comments:**

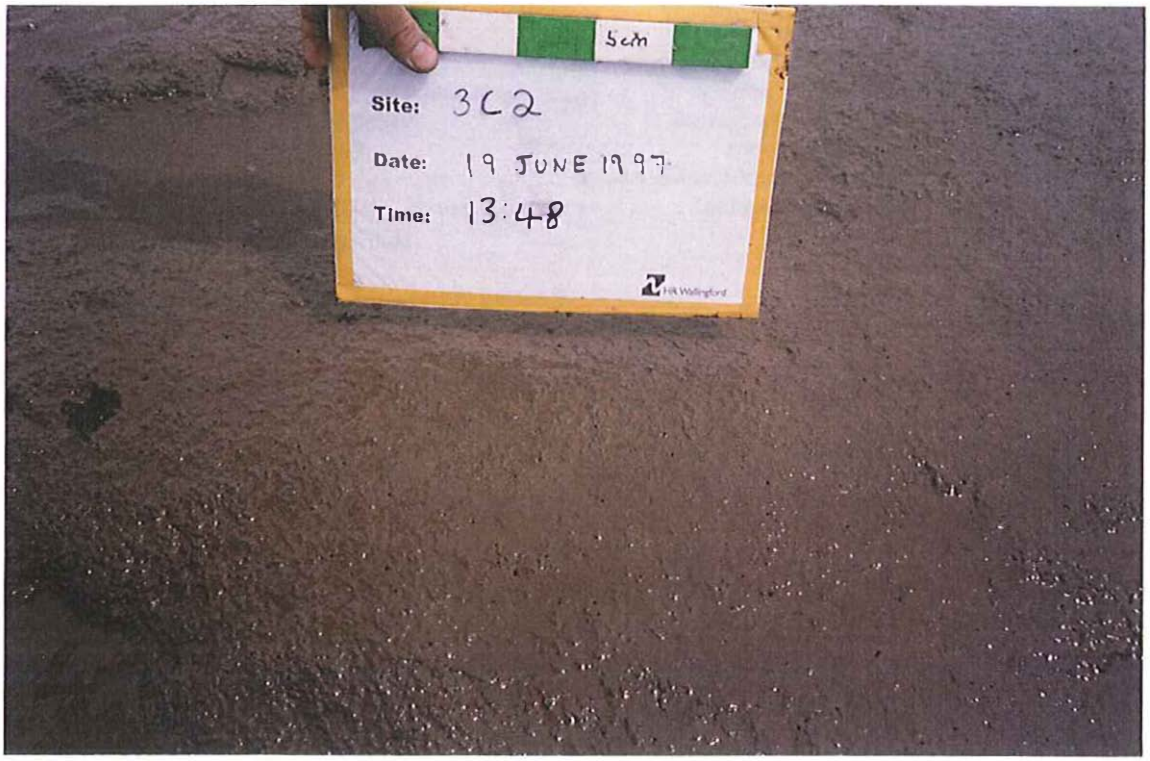
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

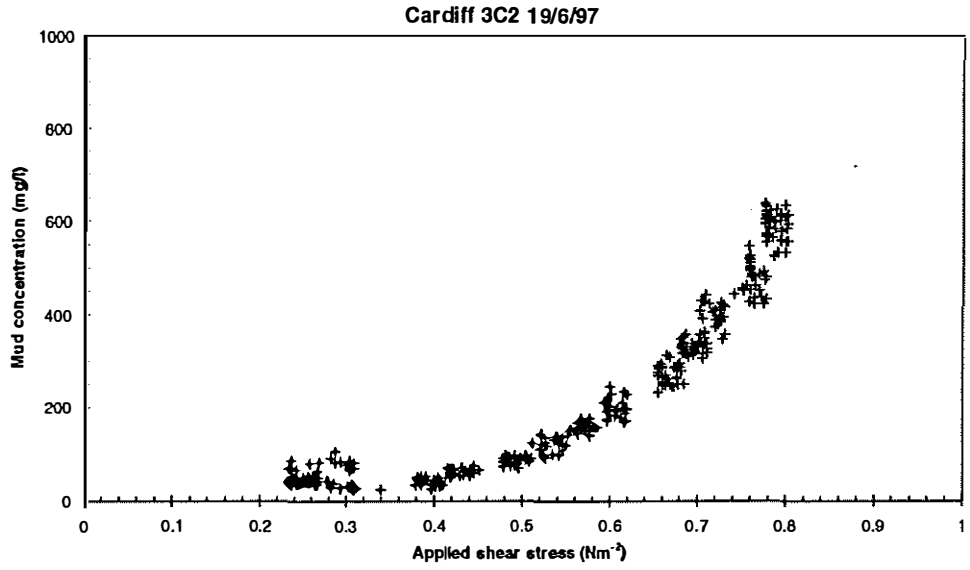
| | | |
|---|---|---|
| $\tau_A$ = | **0.25** | **Nm$^{-2}$** |
| $\tau_B$ = | **0.30** | **Nm$^{-2}$** |
| **Average =** | **0.28** | **Nm$^{-2}$** |

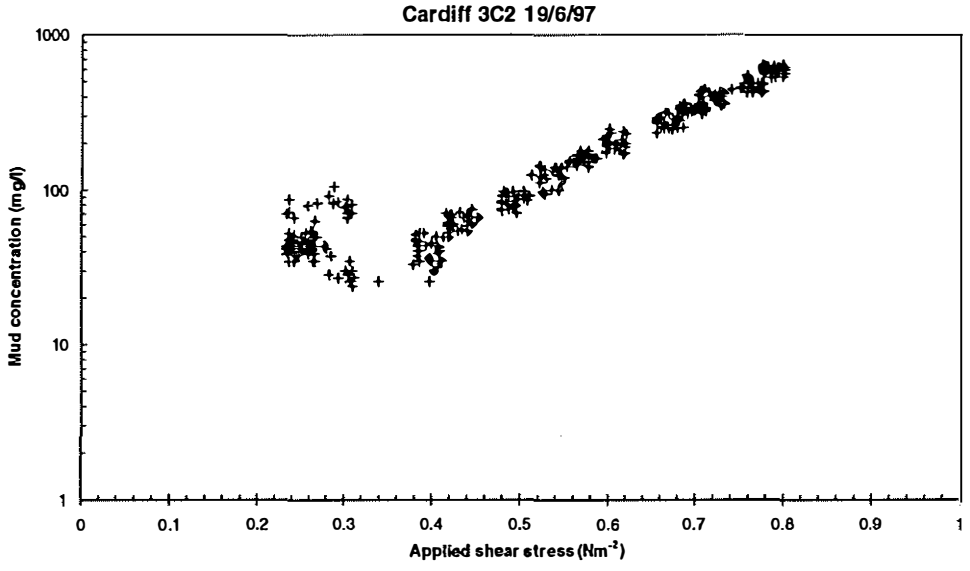


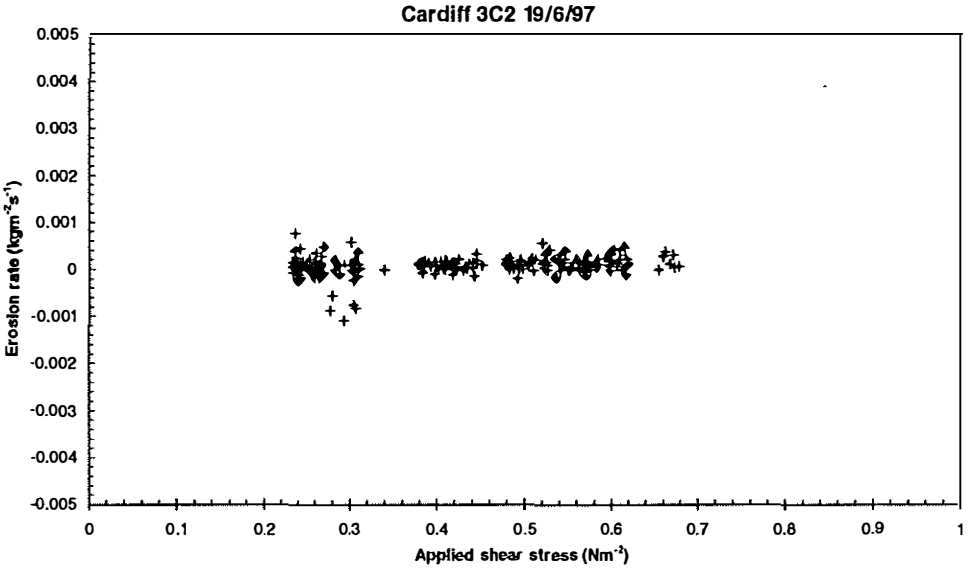

**Site:** **Cardiff seasonal survey June 1997**
Time: 13:50
Date: 19/06/97
Operator: H.J.Mitchener

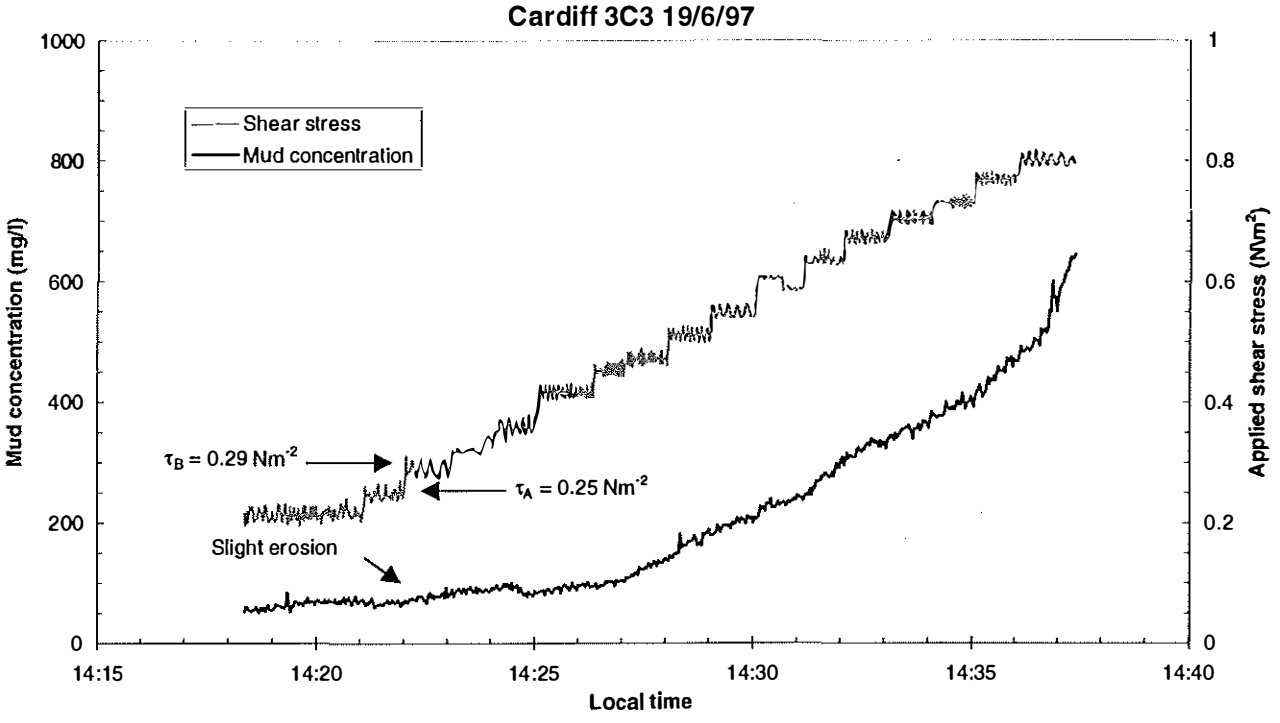
**Photographs:** Time: 13:48
Film: 1
Number: 8




Cardiff 3C2 19/6/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3C2 19/6/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3C2 19/6/97
Erosion rate (kgm-2s-1)
0.005
0.004
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
-0.004
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey May 1997**
Time: 14:15
Date: 19/06/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjun\cjun006.l01

**Site description:**
texture: medium hard gelatinous
colour: mid brown
covering: few worm holes, no hydrobia
topography: lumpy ~ ± 2mm
biologically activity: worms coming out now
composition: clay, scant sand
other features: 1m downstream from 3C2. Sunny now, surface drying, worm trails on surface.

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.8, 0.7, 0.8, 0.6, 0.7
**Average:** 0.7

**Surface sample:** (from top 5mm) - SM16-18

| | | |
|---|---|---|
| Water content: | 207 | % of dry weight |
| Bulk density: | 1263 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 8.89 | % by weight |
| Median size d50: | 1.9 | microns |
| Sand content: | 1.2 | % by weight |
| Silt content: | 48.1 | % by weight |
| Clay content: | 50.7 | % by weight |
| Mud Temperature: | 22.1 | $^0C$ |

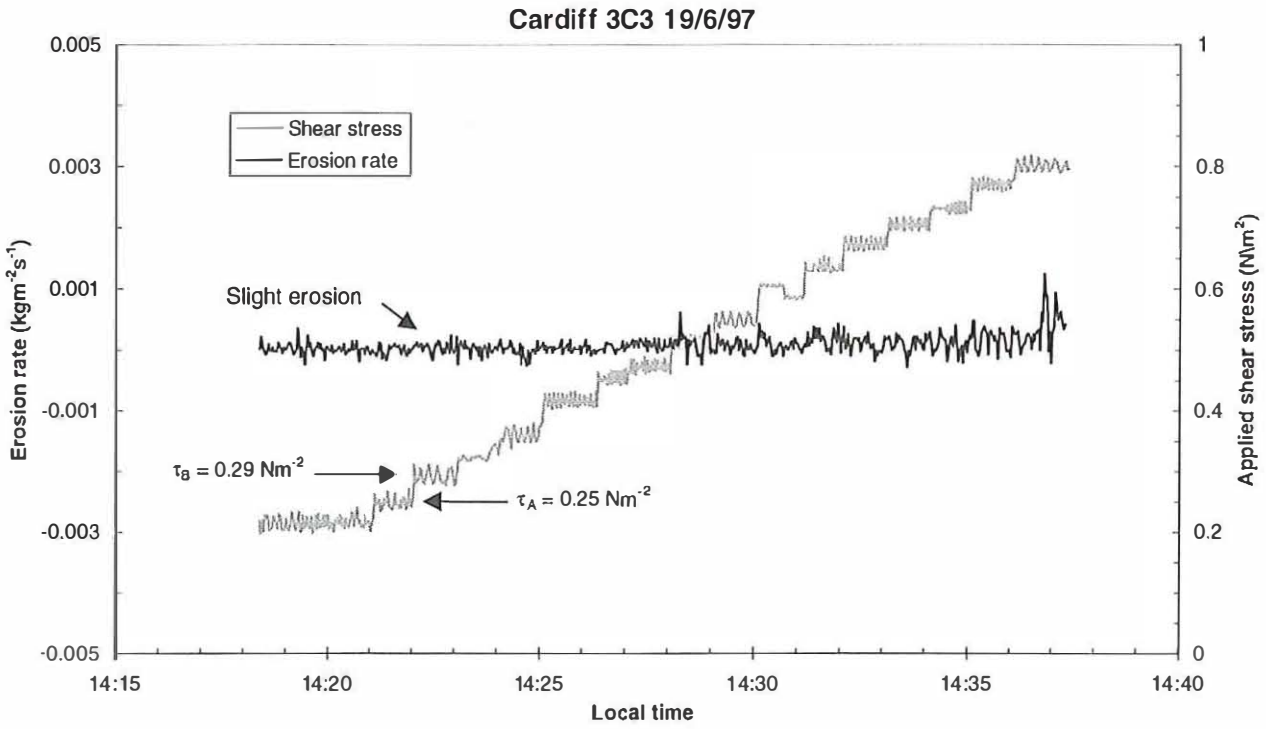
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 14:13 Number: 10

**Comments:**

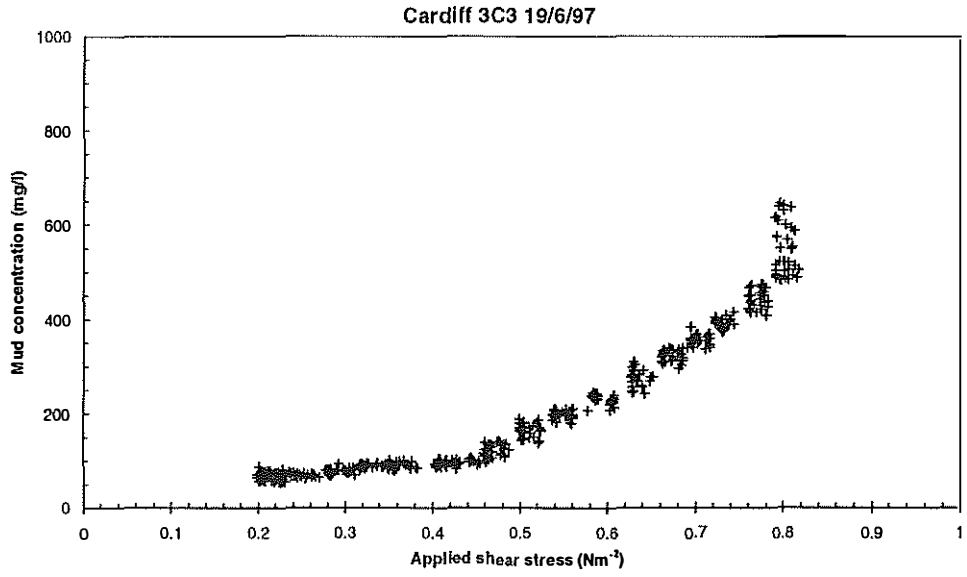
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

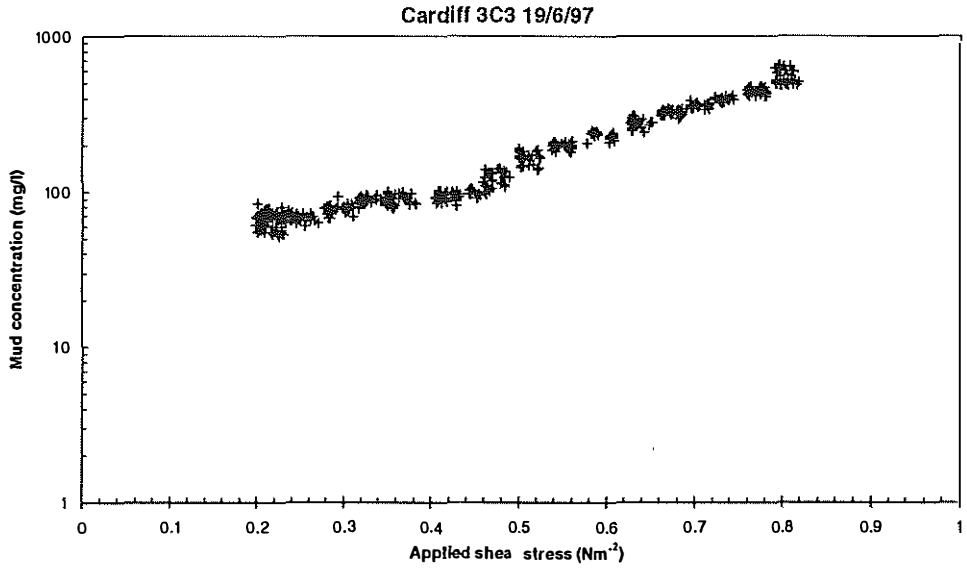
| | | |
|---|---|---|
| $\tau_A$ = | 0.25 | $Nm^{-2}$ |
| $\tau_B$ = | 0.29 | $Nm^{-2}$ |
| **Average** = | 0.27 | $Nm^{-2}$ |

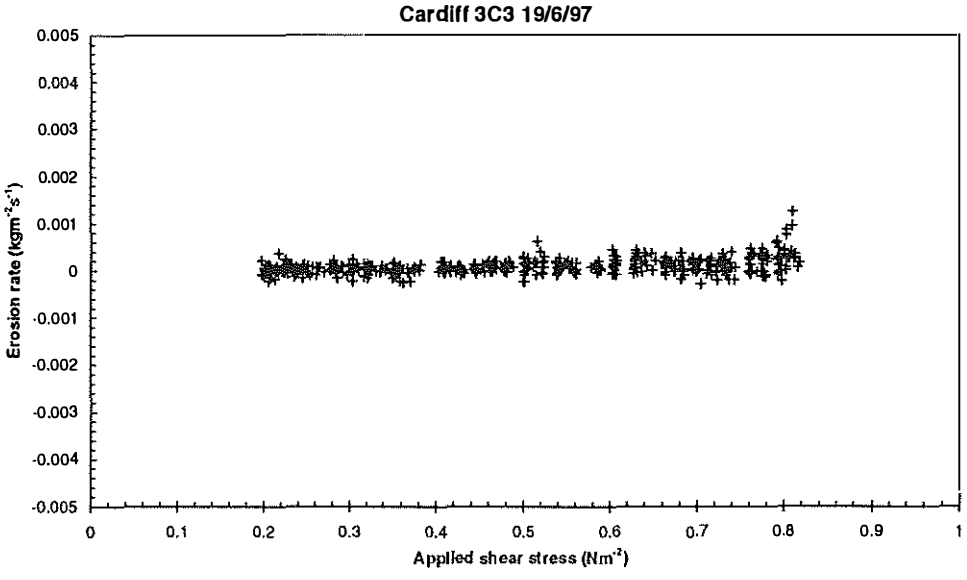


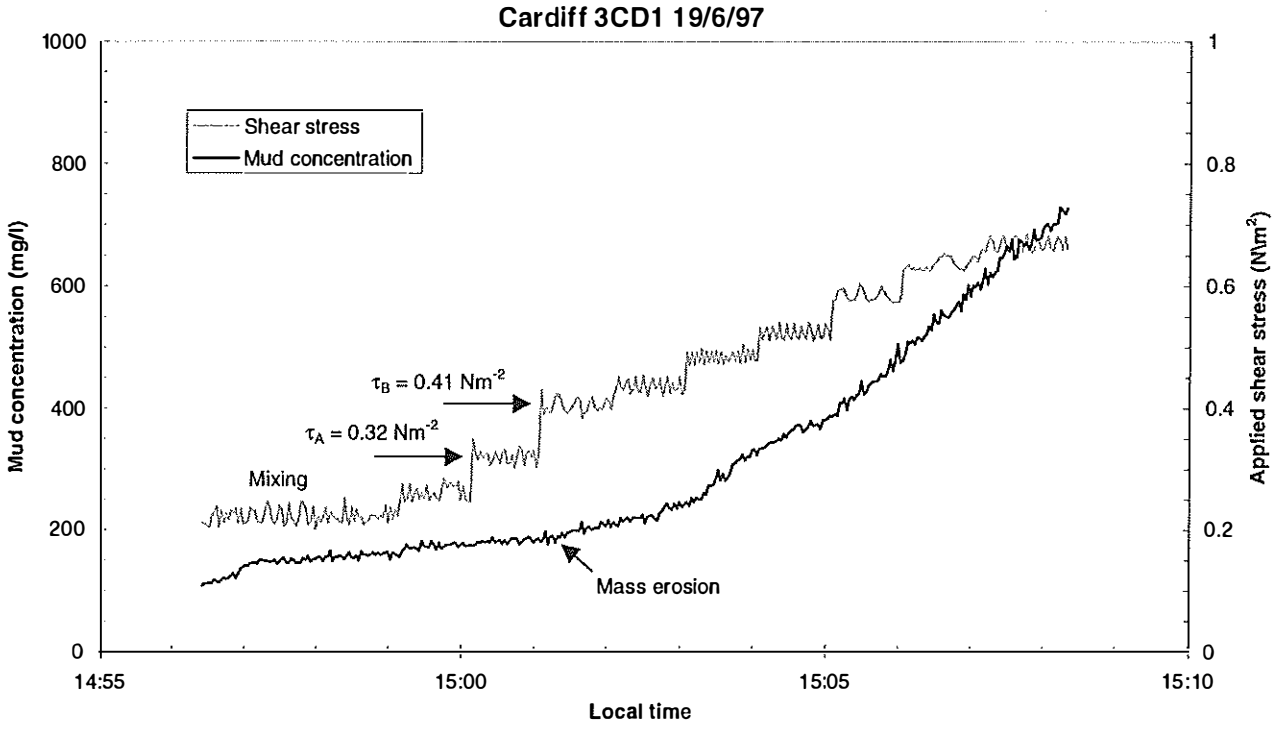

**Site:** **Cardiff seasonal survey June 1997**
Time: 14:15
**Date:** 19/06/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 14:13 Number: 10


Cardiff 3C3 19/6/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3C3 19/6/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shea stress (Nm-2)


Cardiff 3C3 19/6/97
Erosion rate (kgm-2s-1)
0.005
0.004
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
-0.004
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey June 1997**
Time: 14:47
Date: 19/06/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjun\cjun007.l01

**Site description:**
texture: medium hard gelatinous
colour: mid brown
covering: irregular, pits, worm holes
topography: ± 2mm
biologically activity: less than in May, few hydrobia
composition: clay, scant sand
other features: sunny and windy now, drying

**Surface sample:** (from top 5mm) - SM19-21

| | | |
|---|---|---|
| Water content: | 140 | % of dry weight |
| Bulk density: | 1353 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 9.01 | % by weight |
| Median size d50: | 2.3 | microns |
| Sand content: | 3.0 | % by weight |
| Silt content: | 50.3 | % by weight |
| Clay content: | 46.7 | % by weight |
| Mud Temperature: | 19.3 | $^0C$ |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.1, 1.2, 1.1, 1.1, 1.2
Average: 1.1

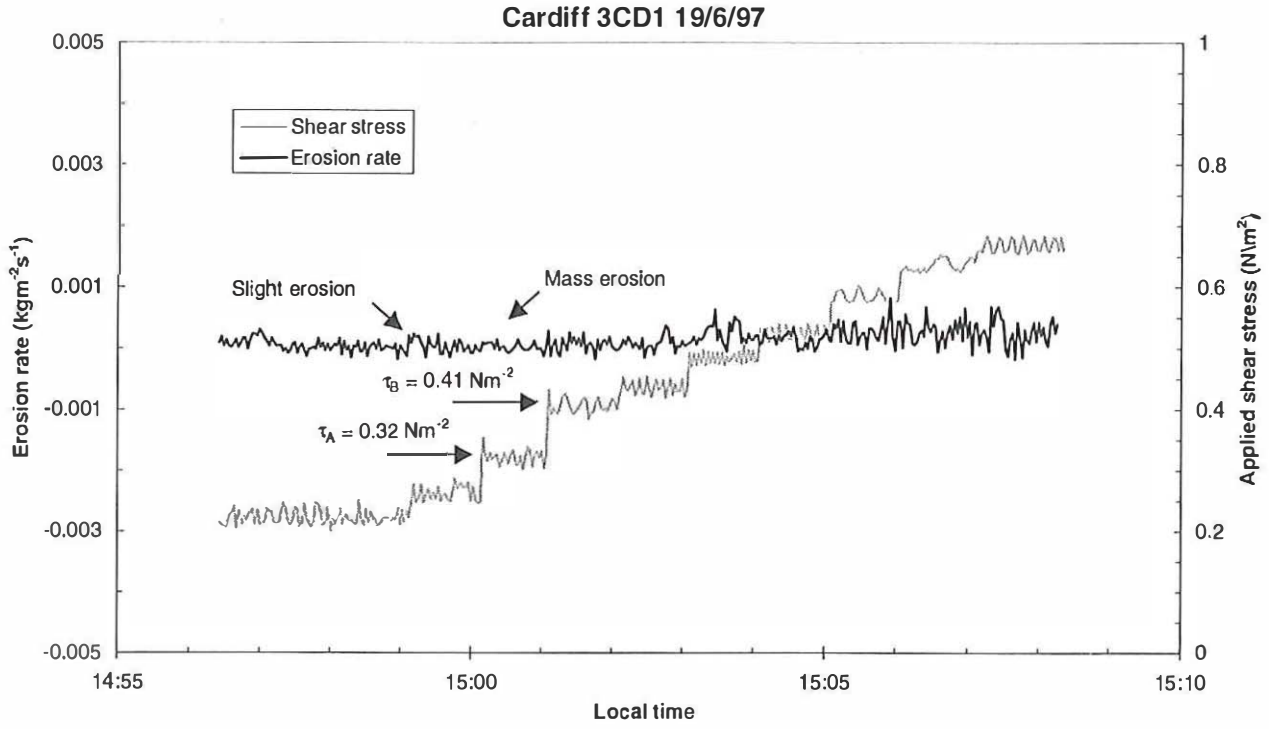
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:**
Film: 1
Time: 14:45 Number: 12

**Comments:**

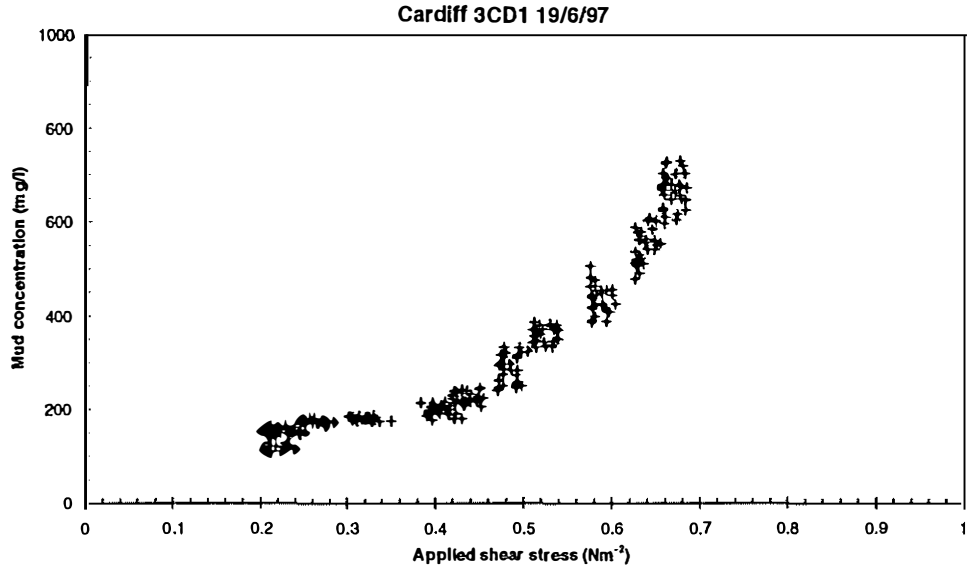
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

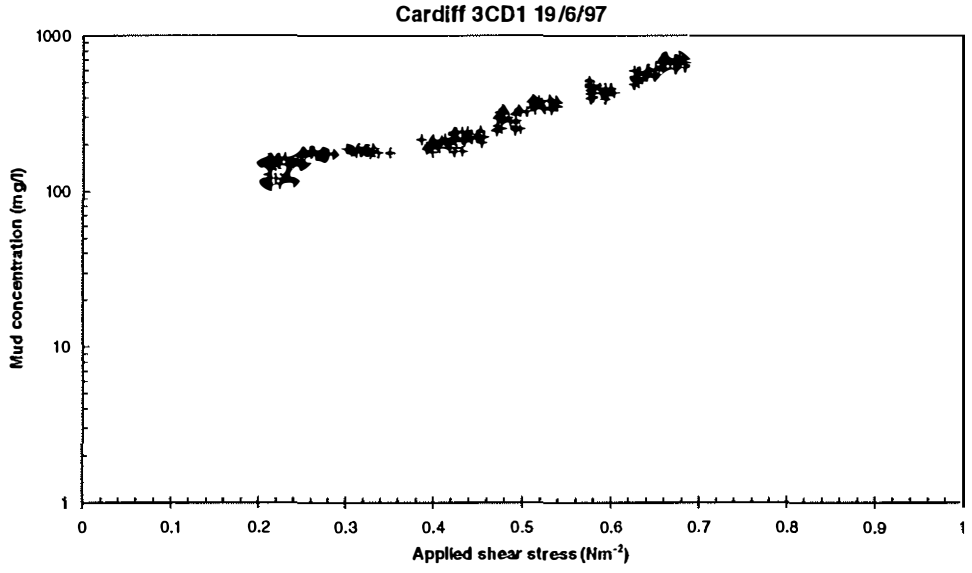
| | | |
|---|---|---|
| $\tau_A$ = | **0.32** | **$Nm^{-2}$** |
| $\tau_B$ = | **0.41** | **$Nm^{-2}$** |
| **Average =** | **0.36** | **$Nm^{-2}$** |

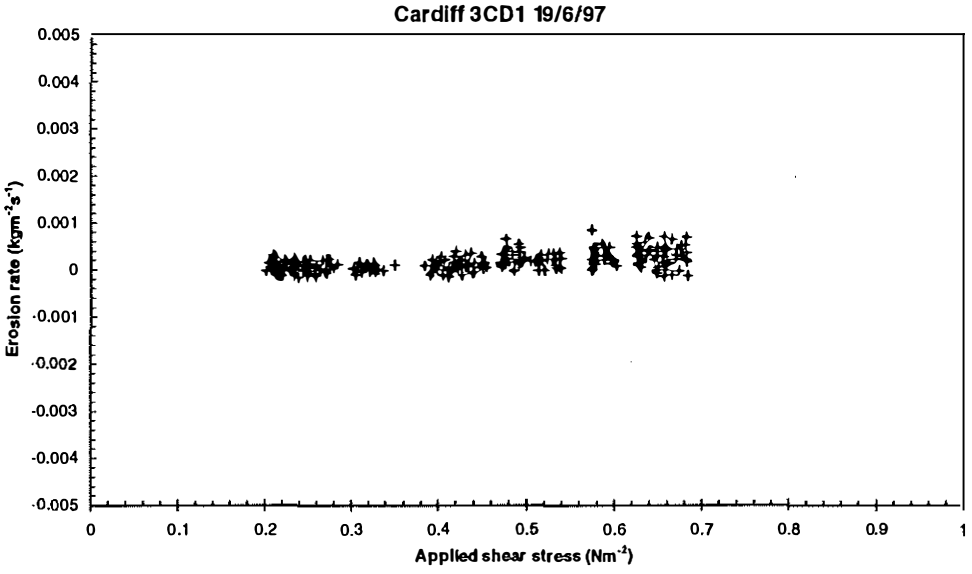


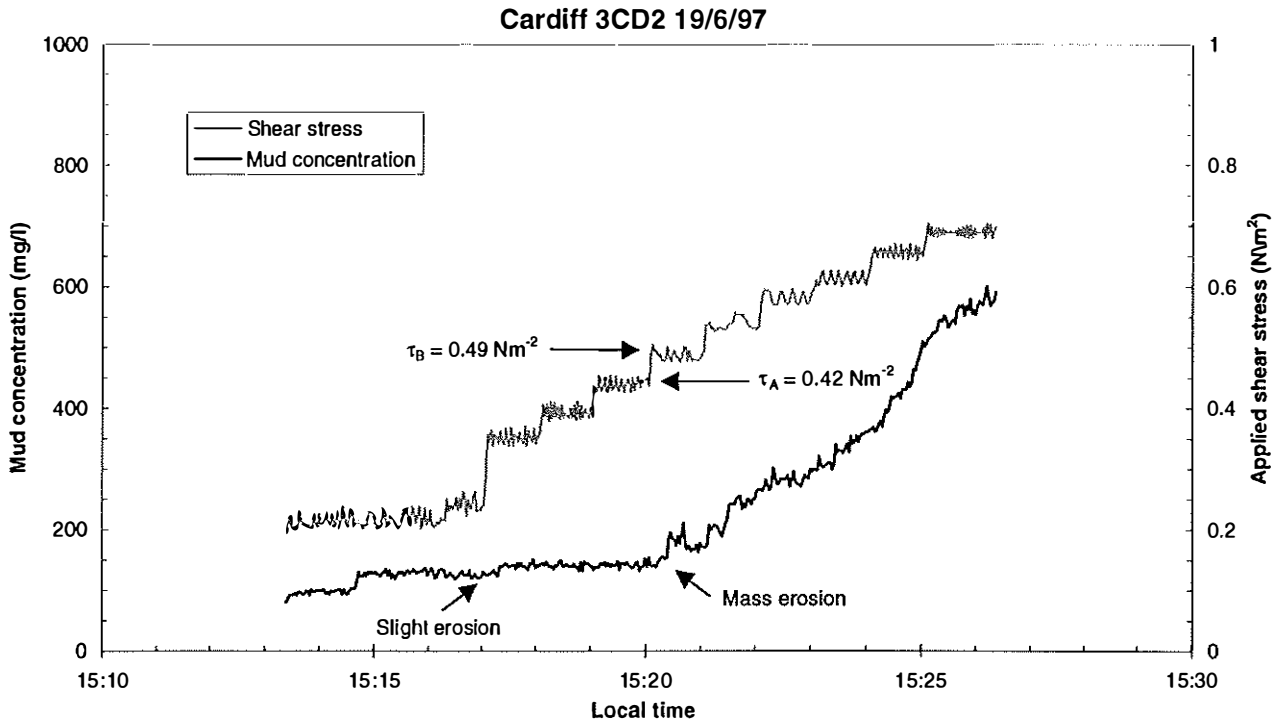

**Site:** **Cardiff seasonal survey June 1997**
Time: 14:47
Date: 19/06/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 14:45 Number: 12


Cardiff 3CD1 19/6/97
Mud concentration (mg/l)
1000
600
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3CD1 19/6/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3CD1 19/6/97
Erosion rate (kgm-2s-1)
0.005
0.004
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
-0.004
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey June 1997**
Time: 15:10
Date: 19/06/97
Operator: H.J.Milchener

**Data file:** (downloaded from Squirrel dala logger)
Path: ..\sediments\helen\intrmud\cardiff\cjun\cjun008.l01

**Site description:**
texture: medium hard gelatinous
colour: mid brown
covering: irregular, pits, worm holes
topography: ± 2mm
biologically activity: less than in May, few hydrobia
composition: clay, scant sand
other features: 1m to East of CD1
Tide coming in fast - 200m away

**Surface sample:** (from top 5mm) - SM22-24

| | | |
|---|---|---|
| Water content: | 139 | % of dry weight |
| Bulk density: | 1355 | kgm$^{-3}$ |
| Carbon (loss on Ignition): | 9.01 | % by weight |
| Median size d50: | 2.7 | microns |
| Sand content: | 3.2 | % by weight |
| Silt content: | 59.9 | % by weight |
| Clay content: | 36.9 | % by weight |
| Mud Temperature: | 20.5 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.1
1.1
1.2
1.1
0.9
Average: 1.1

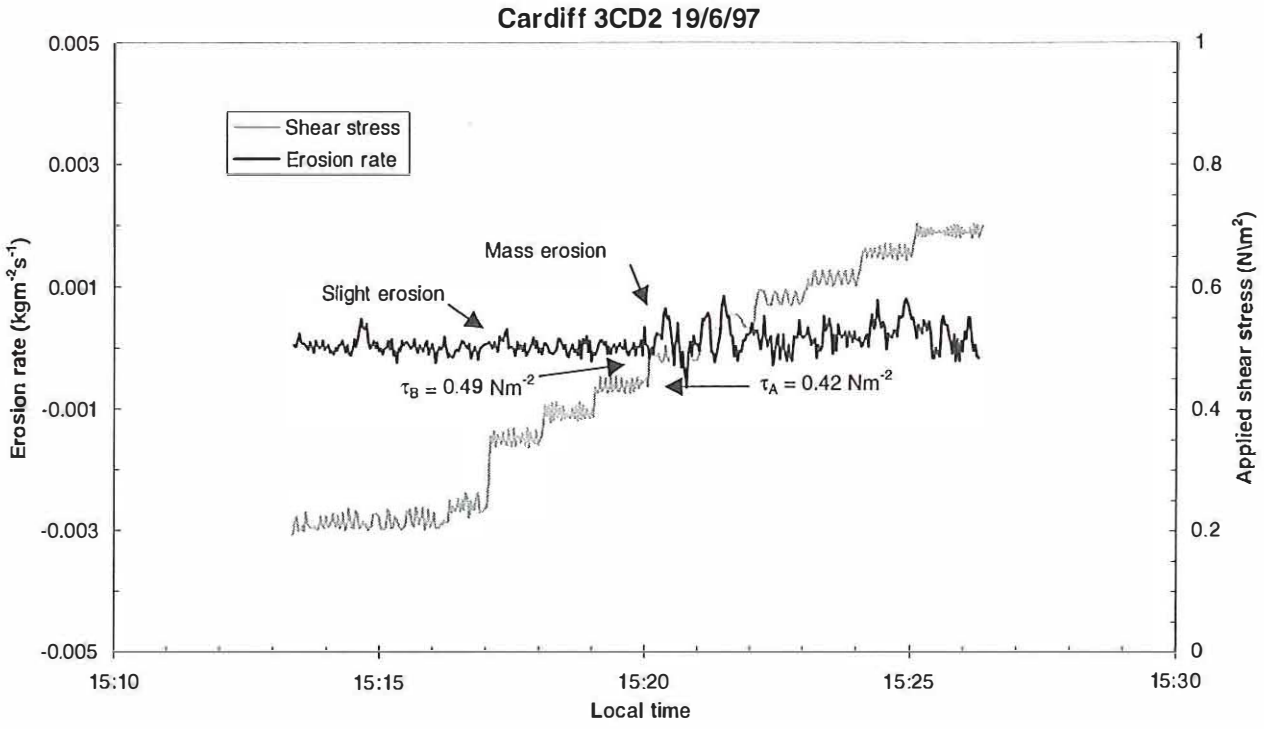
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:**
Time: 15:03
Film: 1
Number: 13

**Comments:**

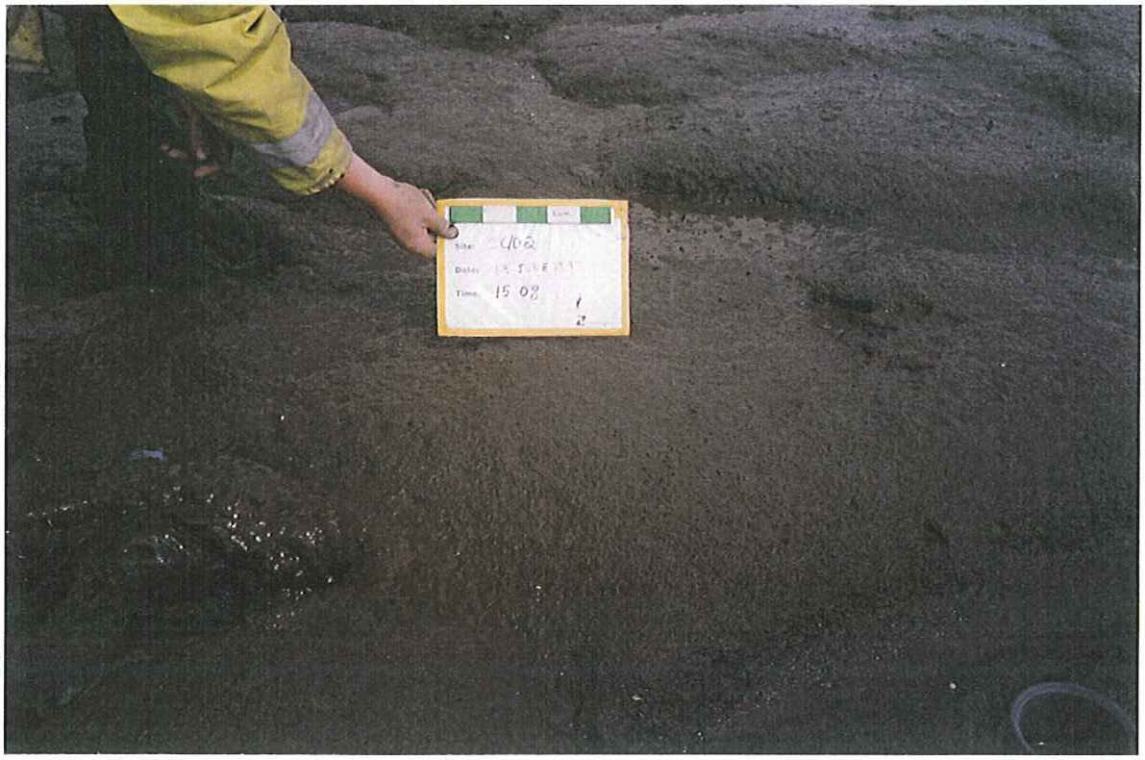
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

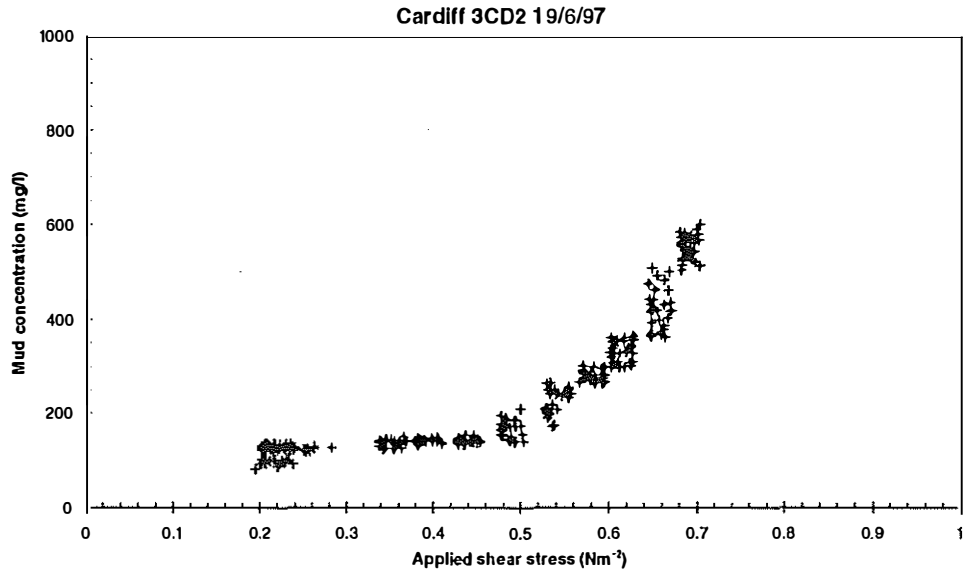
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.42** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.49** | **Nm$^{-2}$** |
| **Average =** | **0.45** | **Nm$^{-2}$** |

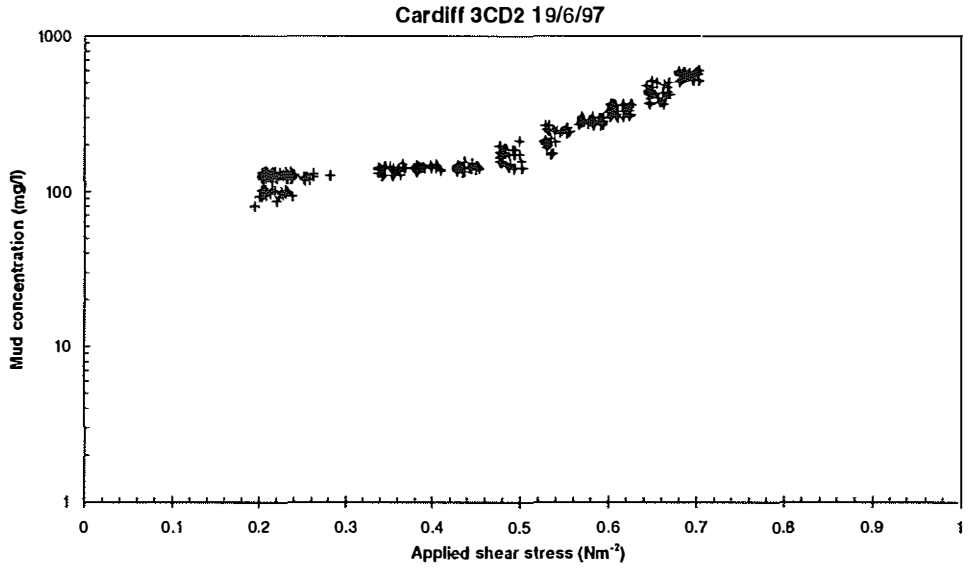


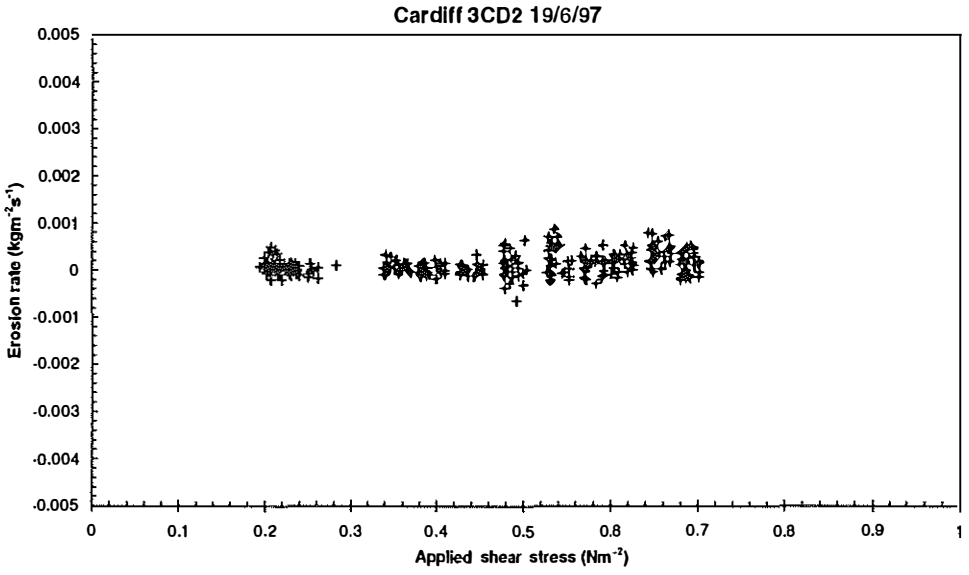

**Site:** **Cardiff seasonal survey June 1997**
Time: 15:10
Date: 19/06/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 15:03 Number: 13



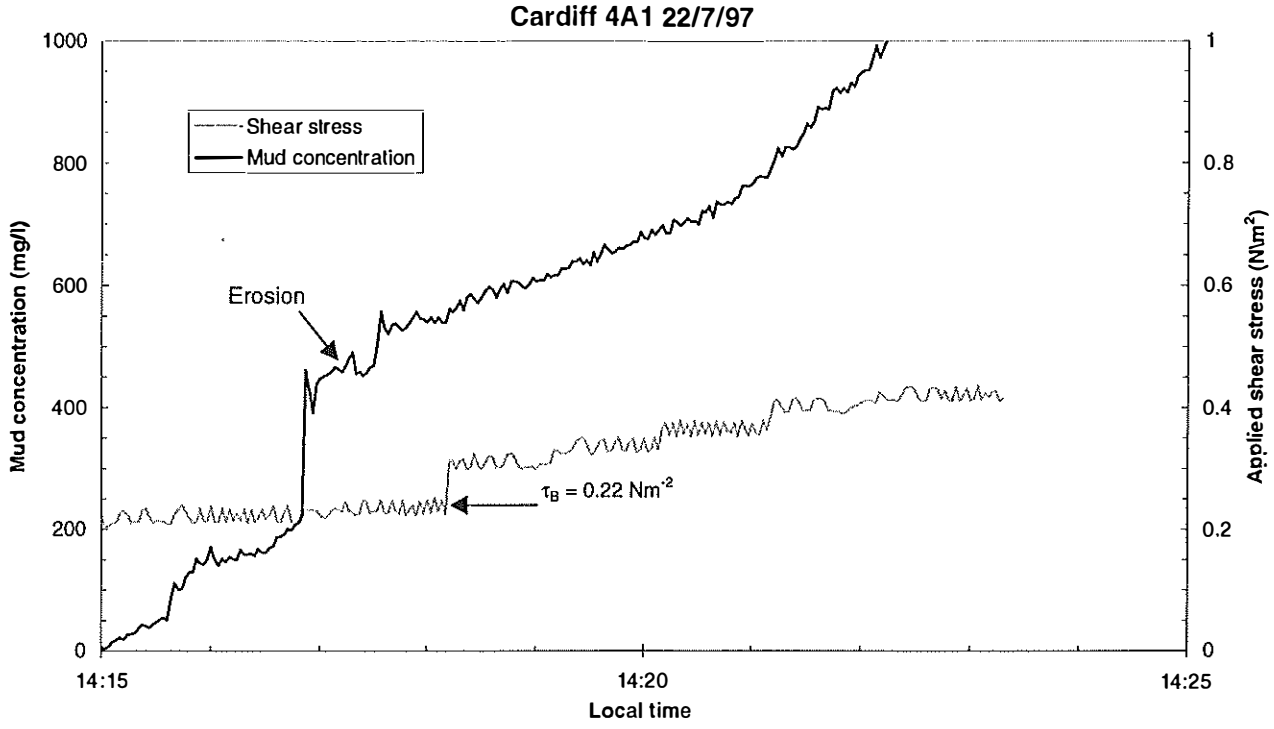

Cardiff 3CD2 19/6/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3CD2 19/6/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 3CD2 19/6/97
Erosion rate (kgm-2s-1)
0.005
0.004
0.003
0.002
0.001
0
-0.001
-0.002
-0.003
-0.004
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)

# SedErode Data Plots

## Cardiff July 1997




**Site:** **Cardiff seasonal survey July 1997**
Time: 13:41
Date: 22/07/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjul\cjul001.l01

**Site description:**
texture: medium soft
colour: pale brown
covering: worms, hydrobia
topography: ±1mm worm tracks
biologically activity: 20-30 worms, 20 hydrobia/10cm diam.
composition: mud, virtually no sand
other features: Tide just out, drying out, very hot + sunny, slight breeze. Thin surface layer - approx 1cm - new deposit (last tide)

**Surface sample:** (from top 5mm) - SM1-3

| | | |
|---|---|---|
| Water content: | 251 | % of dry weight |
| Bulk density: | 1226 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.24 | % by weight |
| Median size d50: | 2.0 | microns |
| Sand content: | 1.8 | % by weight |
| Silt content: | 47.5 | % by weight |
| Clay content: | 50.7 | % by weight |
| Mud Temperature: | 27.5 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.8, 0.9, 0.7, 0.9, 1.0
Average: 0.9

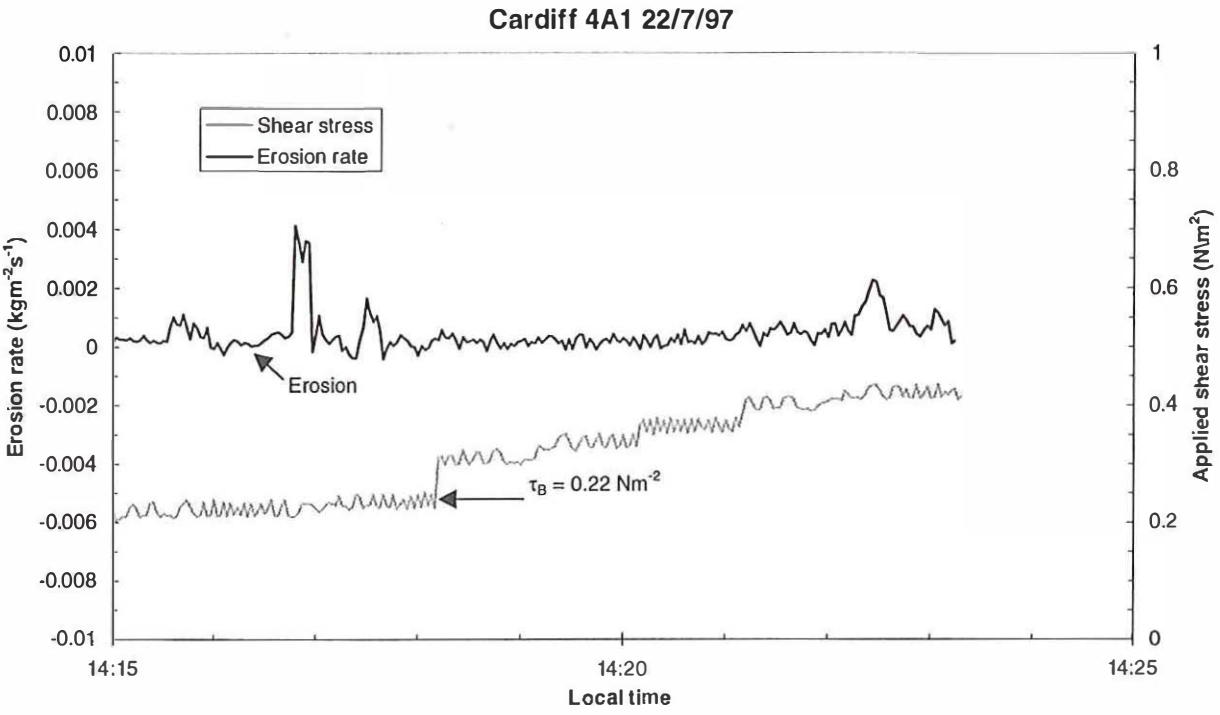
**Eroding Water:** (local collected at HW)
Salinity : 24.34

**Photographs:**
Time: 13:40
Film: 1
Number: 11

**Comments:**

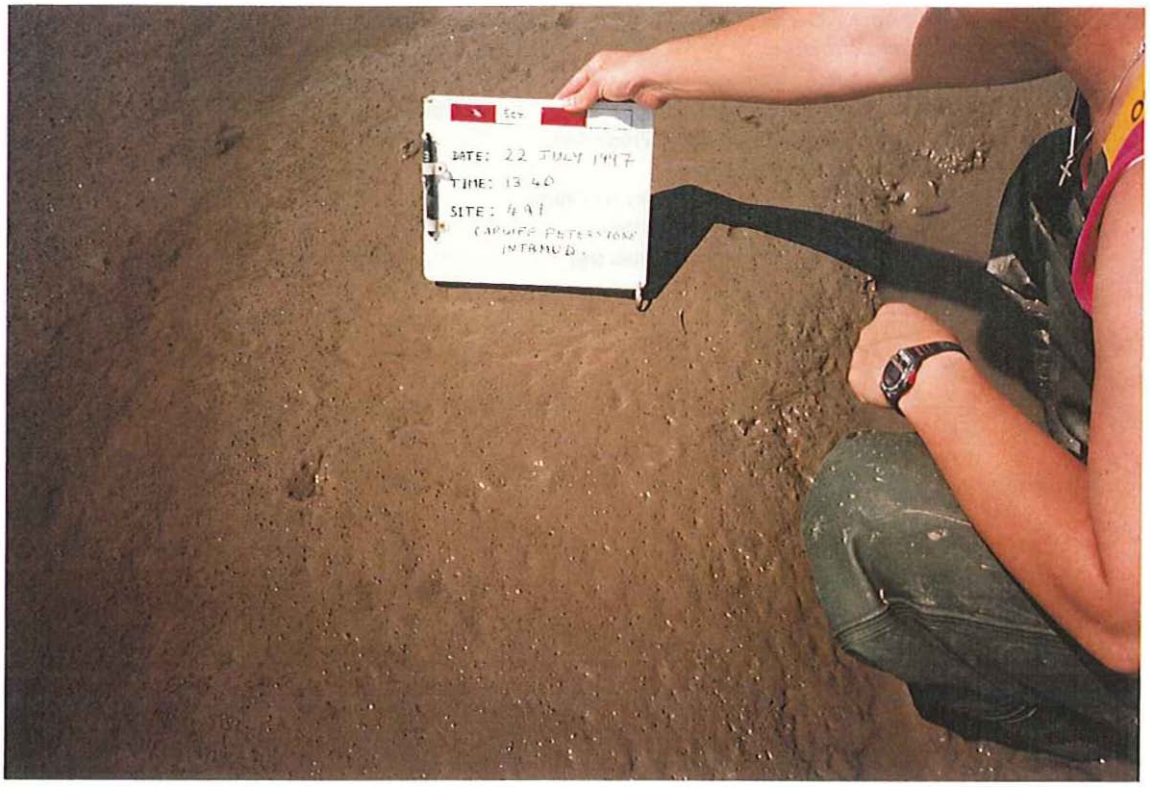
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

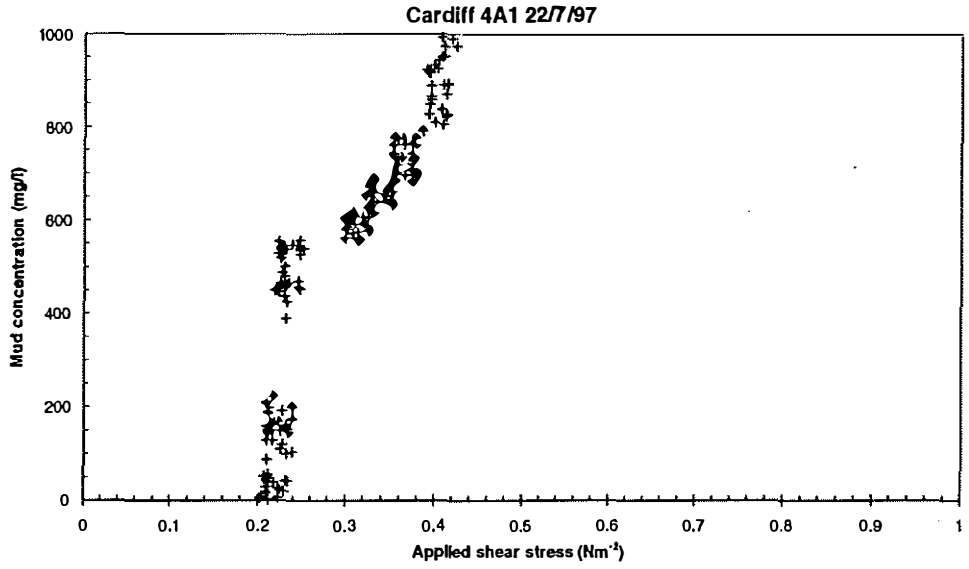
| | | |
|---|---|---|
| $\tau_A$ = | **0.00** | **Nm$^{-2}$** |
| $\tau_B$ = | **0.22** | **Nm$^{-2}$** |
| **Average =** | **0.11** | **Nm$^{-2}$** |

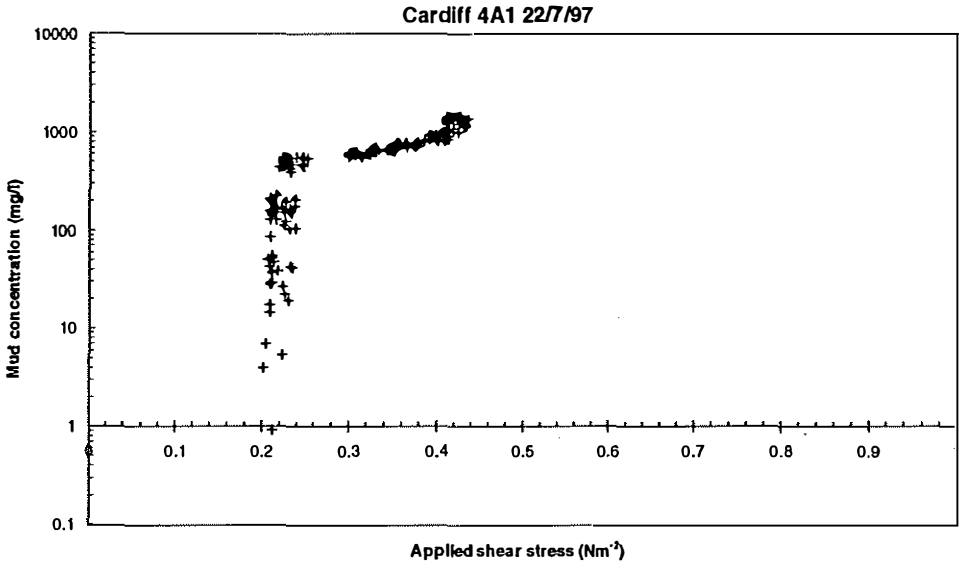


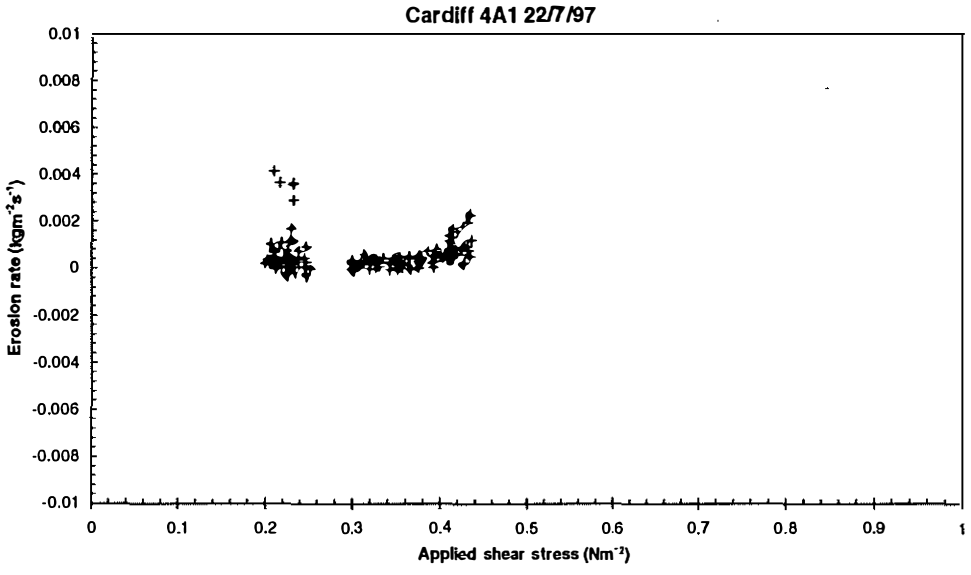

**Site:** **Cardiff seasonal survey July 1997**
Time: 13:41
**Date:** 22/07/97
Operator: H.J.Mitchener

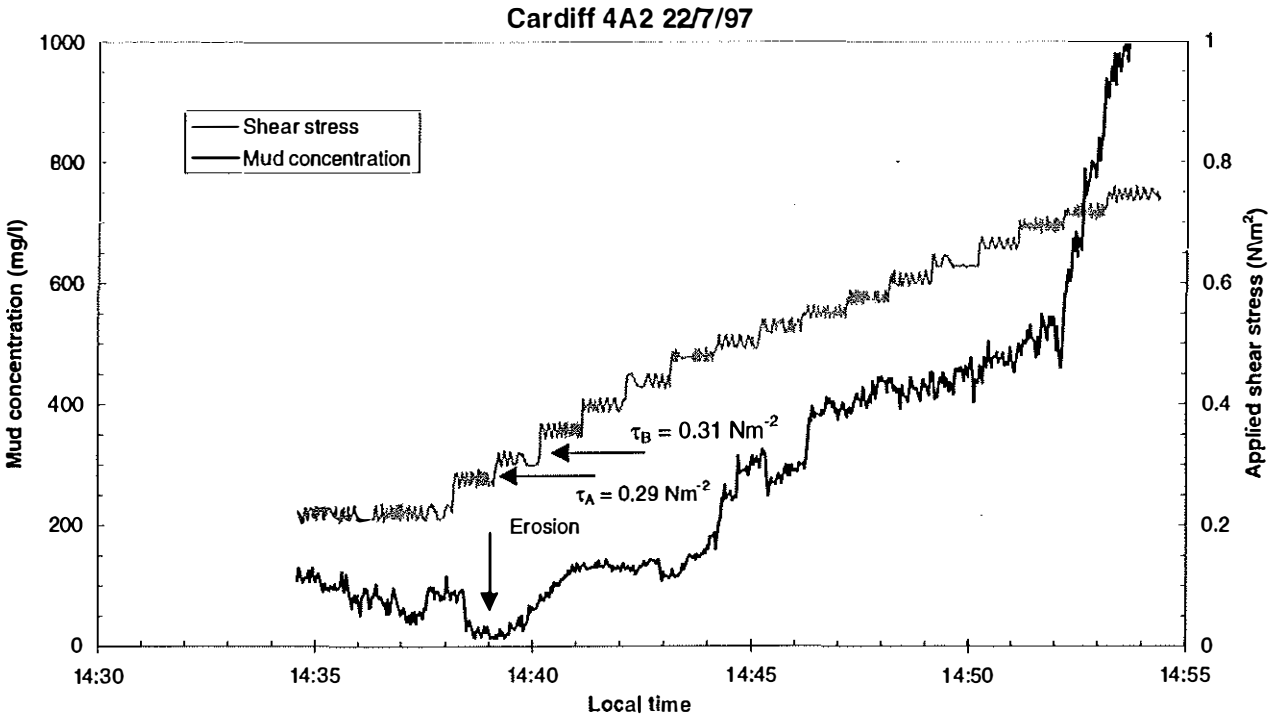
**Photographs:** Film: 1
Time: 13:40 Number: 11




Cardiff 4A1 22/7/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 4A1 22/7/97
Mud concentration (mg/l)
10000
1000
100
10
1
0.1
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Cardiff 4A1 22/7/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey July 1997**
Time: 14:29
Date: 22/07/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjul\cjul002.l01

**Site description:**
texture: medium
colour: pale brown
covering: worms, tracks and holes
topography: ±2mm
biologically activity: 30-35 worms+1-2 hydrobia/10cm diam.
composition: mud, no sand or shells
other features:

**Surface sample:** (from top 5mm) - SM4-6

| | | |
|---|---|---|
| Water content: | 189 | % of dry weight |
| Bulk density: | 1282 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 9.82 | % by weight |
| Median size d50: | 1.6 | microns |
| Sand content: | 2.1 | % by weight |
| Silt content: | 41.7 | % by weight |
| Clay content: | 56.2 | % by weight |
| Mud Temperature: | 29 | $^0C$ |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.9, 0.9, 1.1, 1.2, 0.9
Average: 1.0

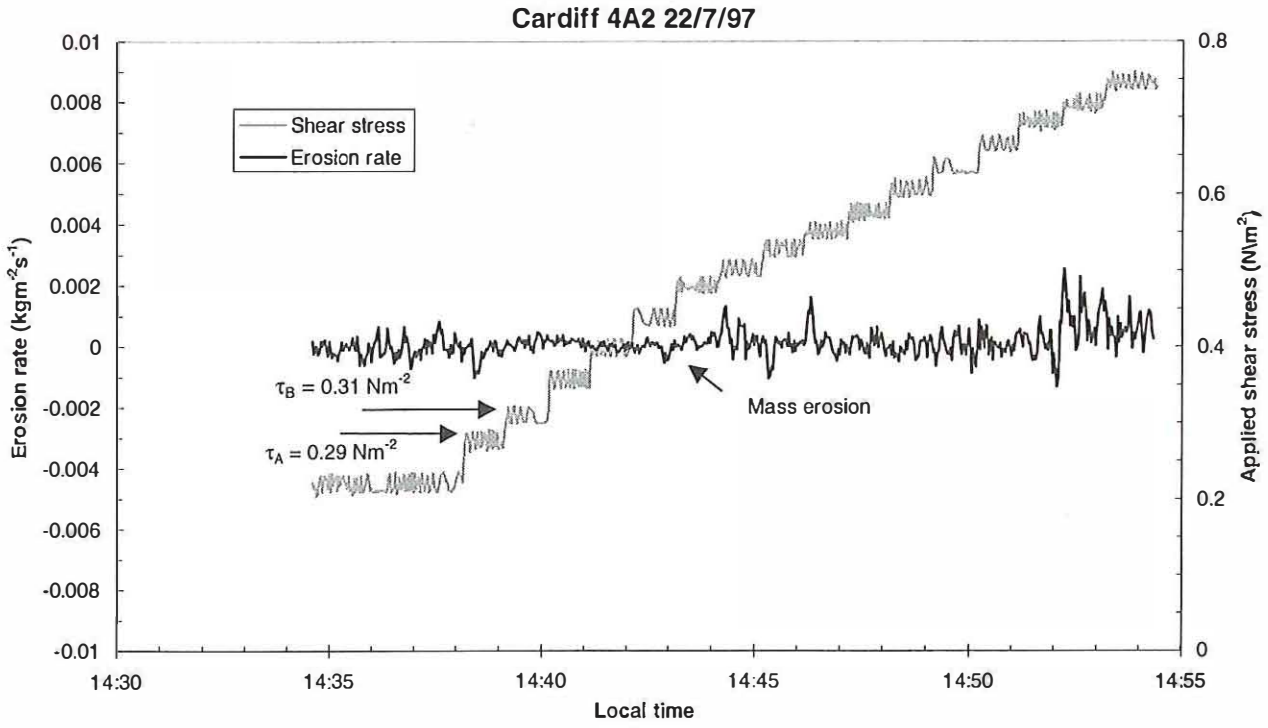
**Eroding Water:** (local collected at HW)
Salinity : 24.34

**Photographs:**
Time: 14:27
Film: 1
Number: 12
Number: 13 After erosion

**Comments:**

**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

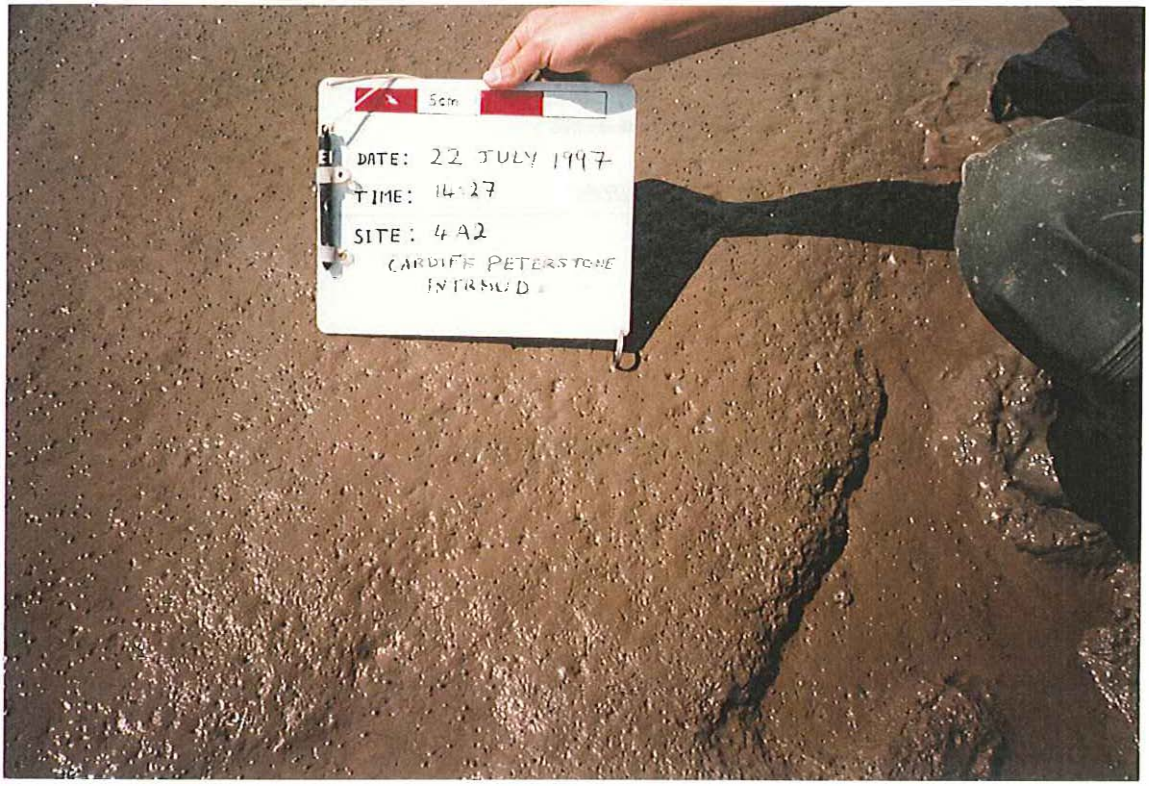
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.29** | **$Nm^{-2}$** |
| **$\tau_B$ =** | **0.31** | **$Nm^{-2}$** |
| **Average =** | **0.30** | **$Nm^{-2}$** |

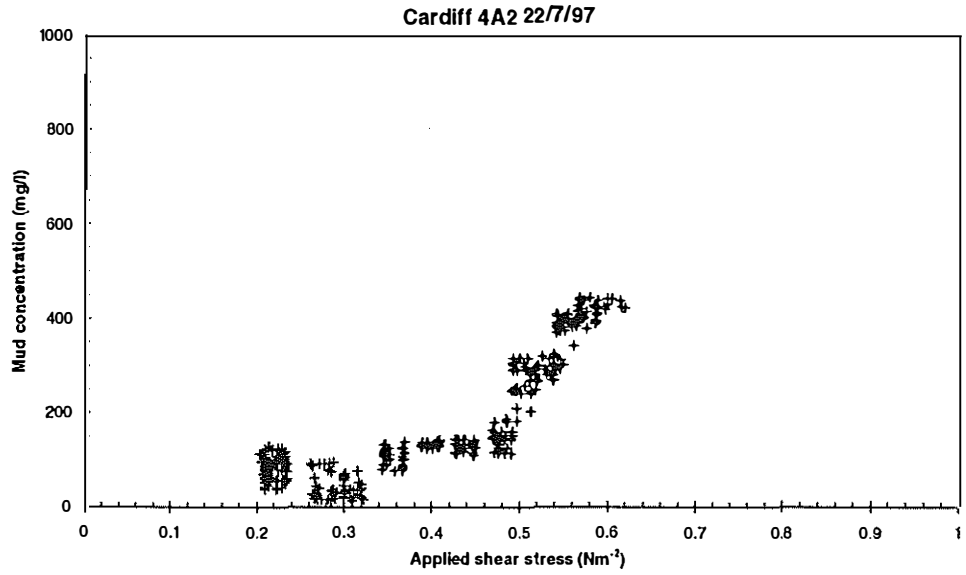


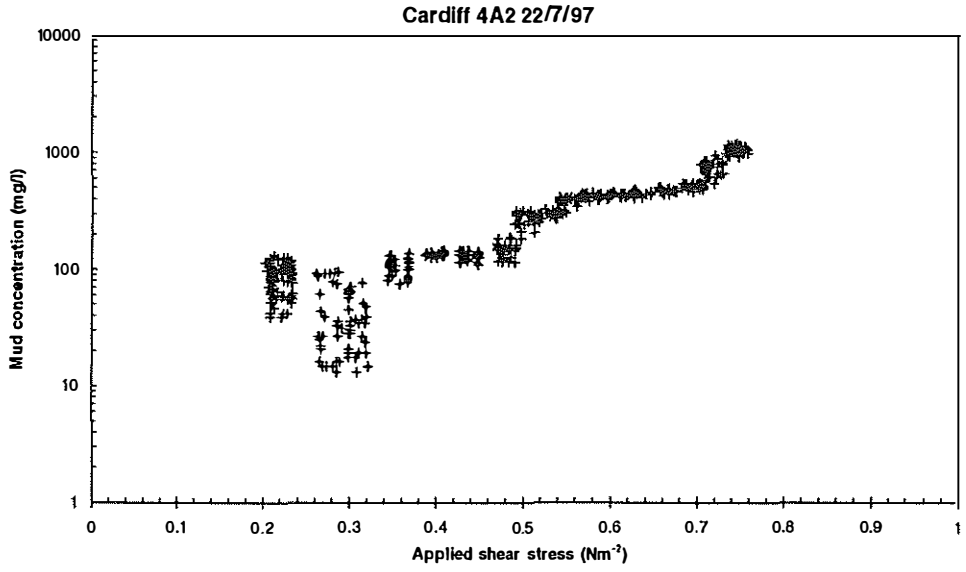

**Site:** **Cardiff seasonal survey July 1997**
Time: 14:29
Date: 22/07/97
Operator: H.J.Mitchener

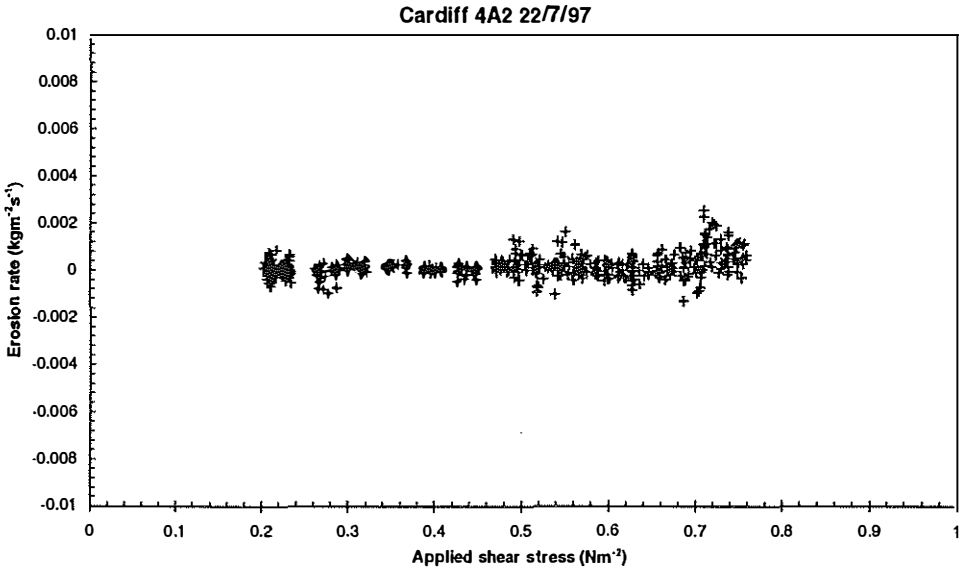
**Photographs:**
Time: 14:27

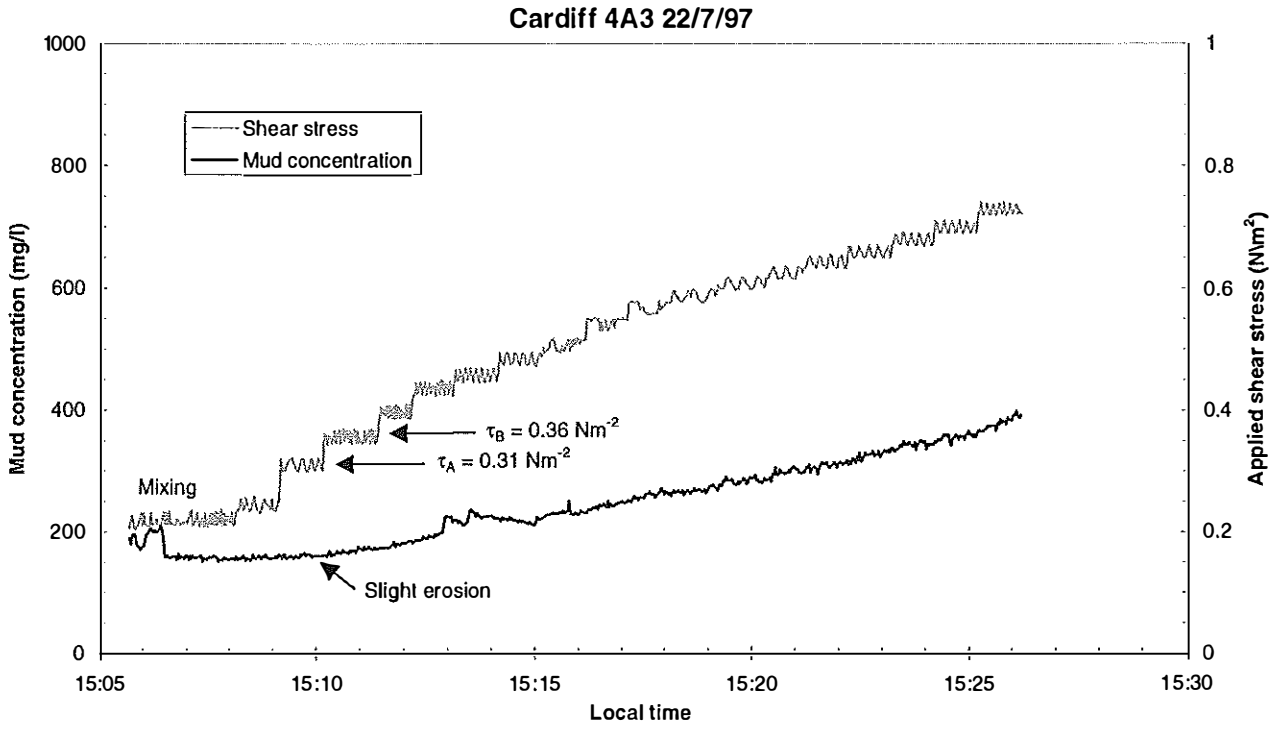
Film: 1
Number: 12
Number: 13 After erosion




Cardiff 4A2 22/7/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Cardiff 4A2 22/7/97
Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Cardiff 4A2 22/7/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey July 1997**
Time: 15:01
Date: 22/07/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjul\cjul003.l01

**Site description:**

| | |
|---|---|
| texture: | medium - getting harder |
| colour: | mid brown |
| covering: | worm holes, no hydrobia |
| topography: | ±1mm |
| biologically activity: | ~ 25 worms/10cm diam. |
| composition: | mud, worms, no sand |
| other features: | on ridge - drying out in sunshine - very hot |

**Surface sample:** (from top 5mm) - SM7-9

| | | |
|---|---|---|
| Water content: | 161 | % of dry weight |
| Bulk density: | 1318 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.11 | % by weight |
| Median size d50: | 1.9 | microns |
| Sand content: | 1.4 | % by weight |
| Silt content: | 47.4 | % by weight |
| Clay content: | 51.2 | % by weight |
| Mud Temperature: | 28.5 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.1
1.1
1.3
1.1
1.1
Average: 1.1

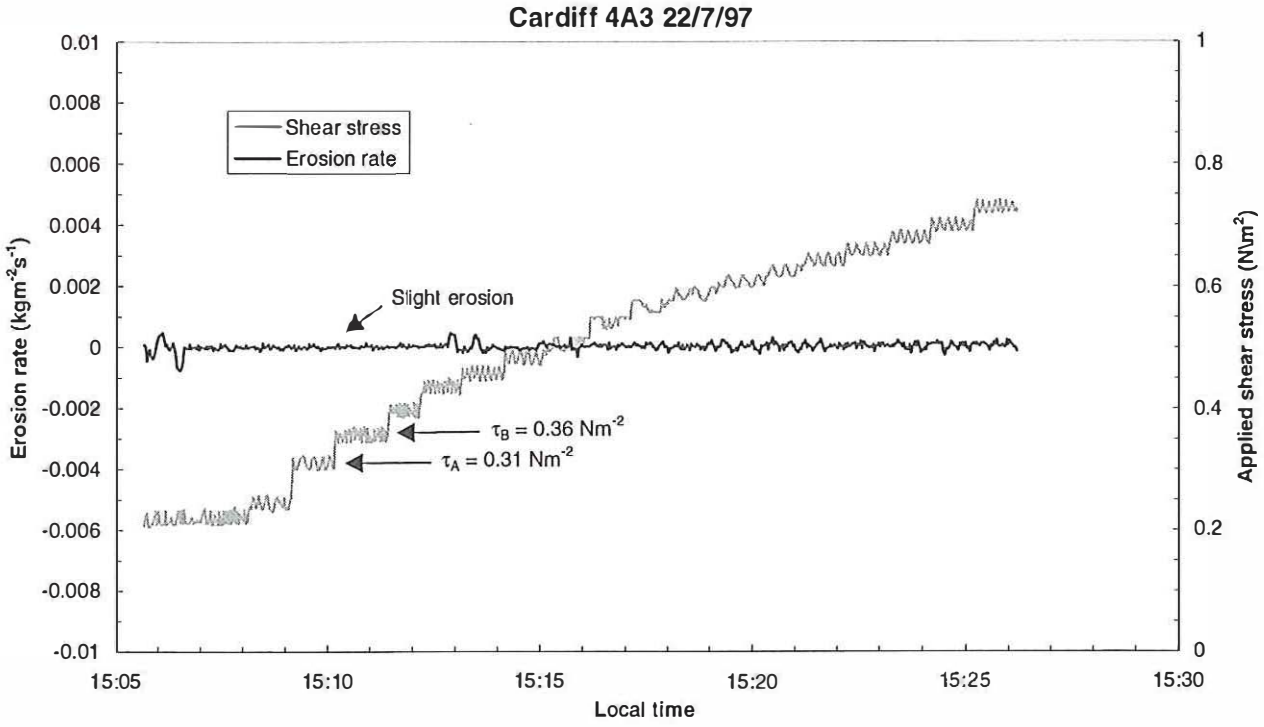
**Eroding Water:** (local collected at HW)
Salinity : 24.34

**Photographs:**
Time: 14:58
Film: 1
Number: 14
Number: 15 After erosion

**Comments:**

**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

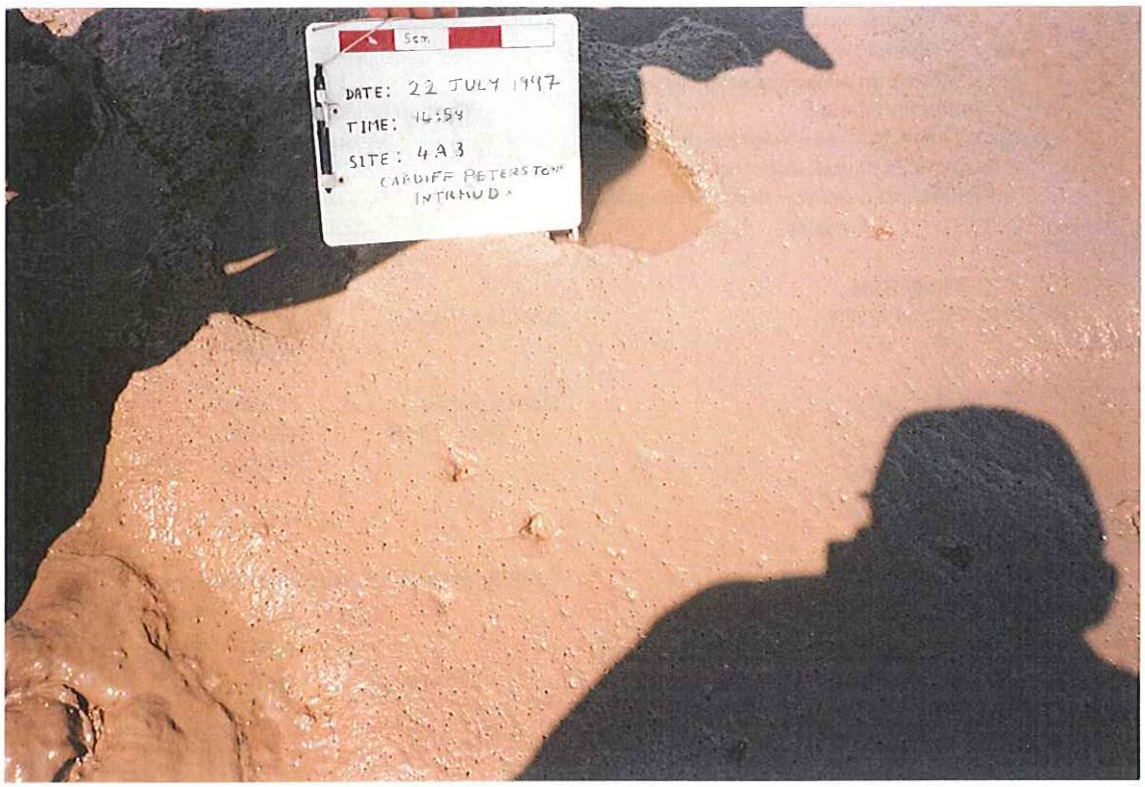
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.31** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.36** | **Nm$^{-2}$** |
| **Average =** | **0.33** | **Nm$^{-2}$** |

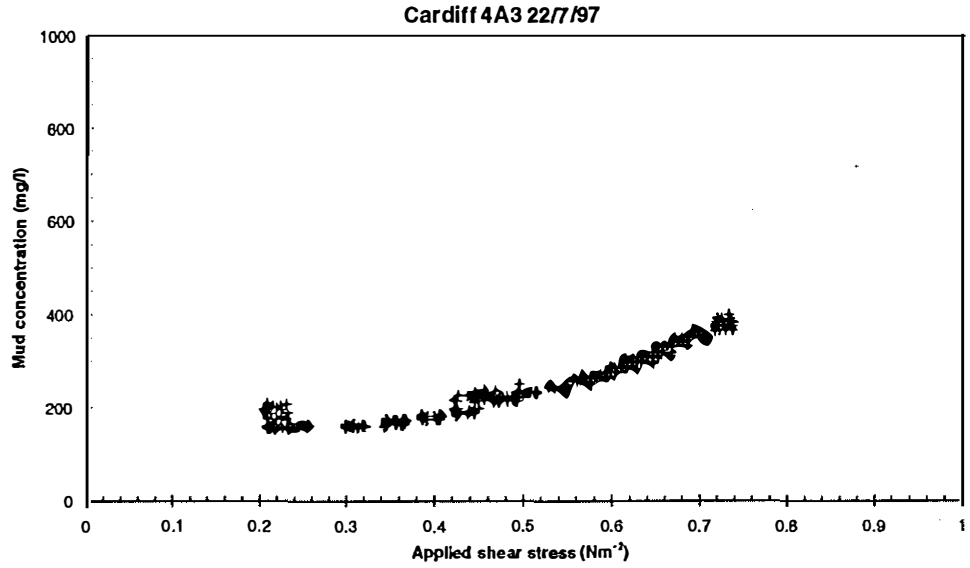


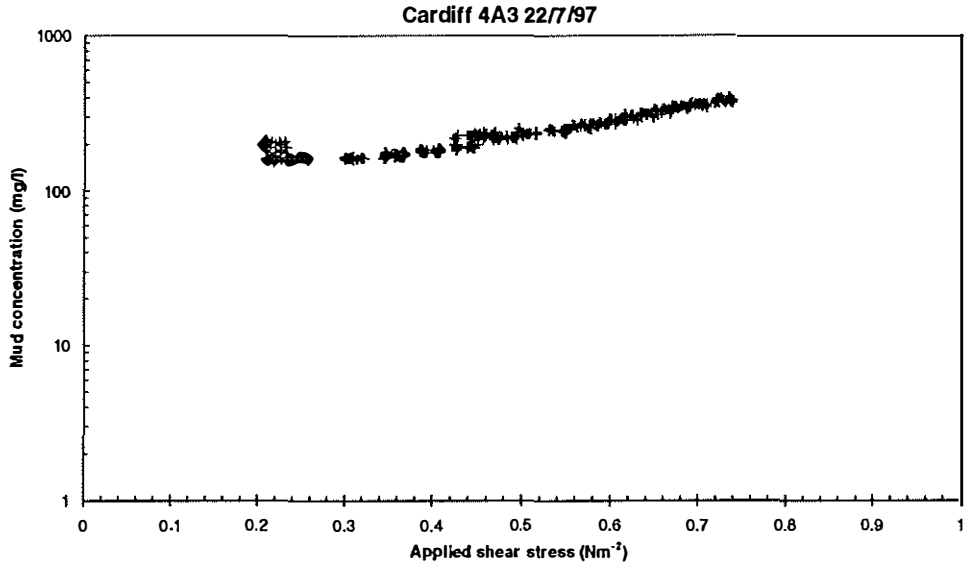

**Site:** **Cardiff seasonal survey July 1997**
Time: 15:01
Date: 22/07/97
Operator: H.J.Mitchener

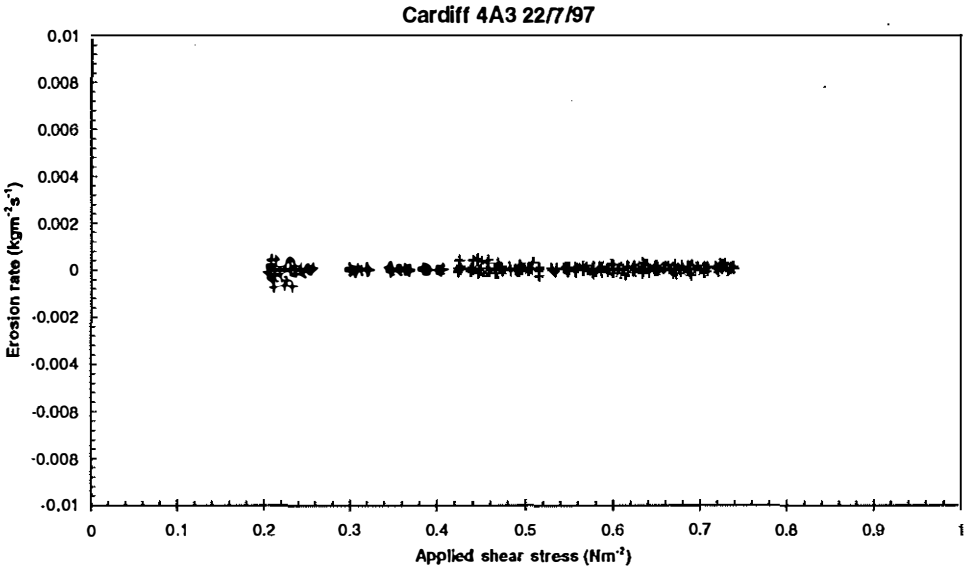
**Photographs:**
Time: 14:58

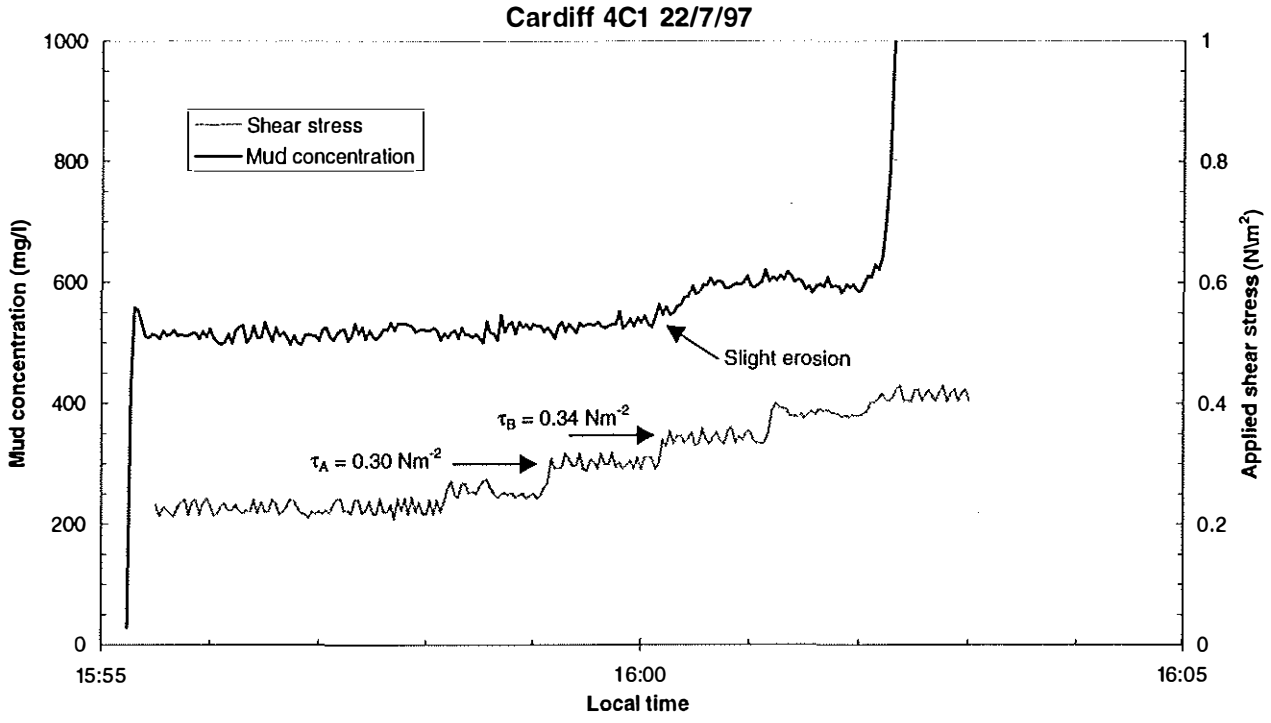
Film: 1
Number: 14
Number: 15 After erosion




Cardiff 4A3 22/7/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Cardiff 4A3 22/7/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Cardiff 4A3 22/7/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.008
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey July 1997**
Time: 15:51
Date: 22/07/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjul\cjul004.l01

**Site description:**
texture: medium soft
colour: pale brown
covering: worms and hydrobla, water around
topography: ± 2mm
biologically activity: 20 worms+20 hydrobla/10cm diam.
composition: watery mud
other features: Drying out, soft surface deposit

**Surface sample:** (from top 5mm) - SM10-12

| | | |
|---|---|---|
| Water content: | 194 | % of dry weight |
| Bulk density: | 1276 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.50 | % by weight |
| Median size d50: | 1.8 | microns |
| Sand content: | 2.5 | % by weight |
| Silt content: | 45.3 | % by weight |
| Clay content: | 52.2 | % by weight |
| Mud Temperature: | 27 | $^0$C |

**Shear vane:** 33mm vane
Obseiver: Damon O'Brien
Measurements (kPa): 0.7
0.6
0.5
0.3
0.4
Average: 0.5

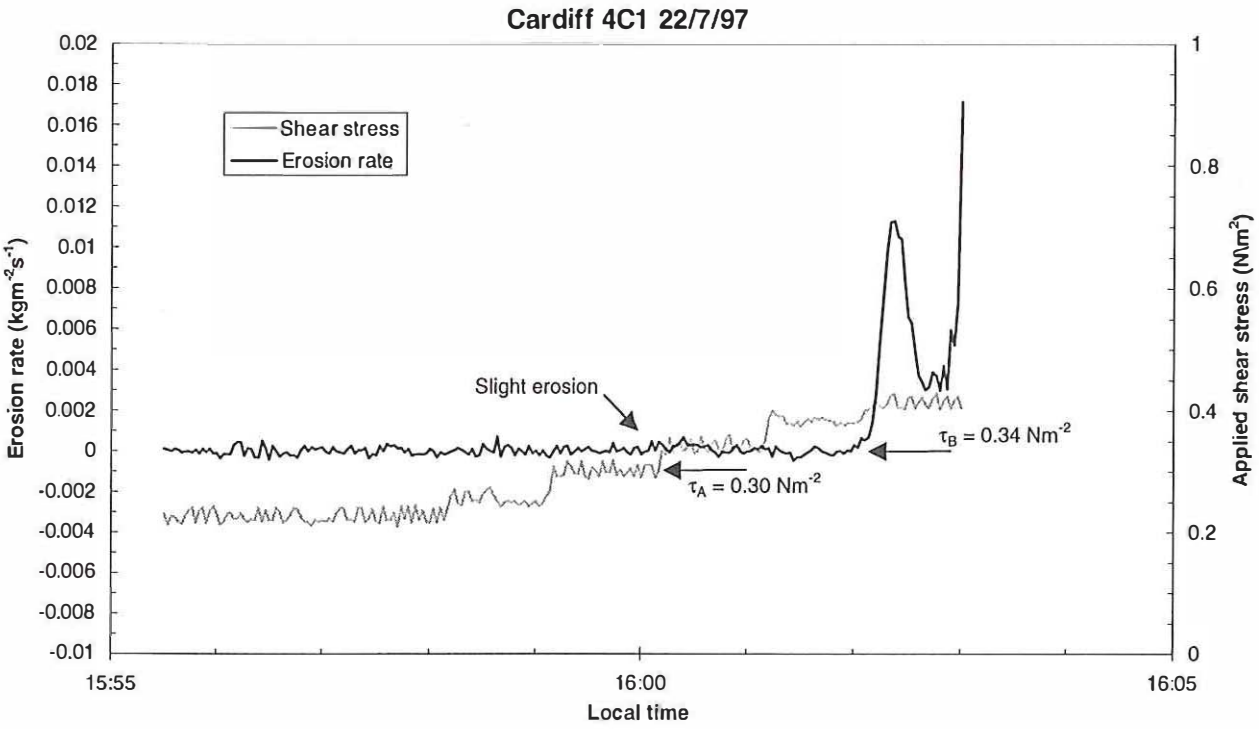
**Eroding Water:** (local collected at HW)
Salinity : 24.34

**Photographs:** Film: 1
Time: 15:50 Number: 16

**Comments:**

**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

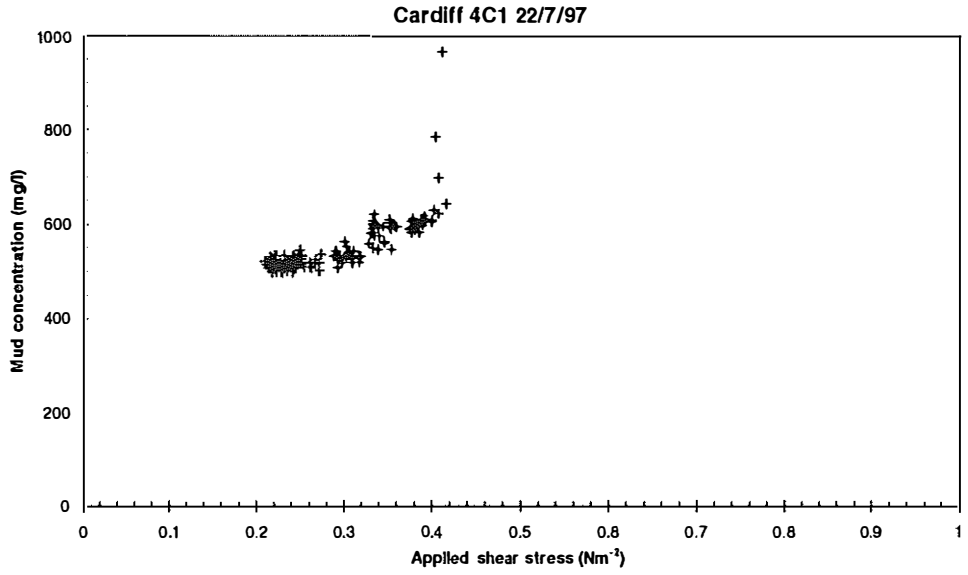
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.30** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.34** | **Nm$^{-2}$** |
| **Average =** | **0.32** | **Nm$^{-2}$** |

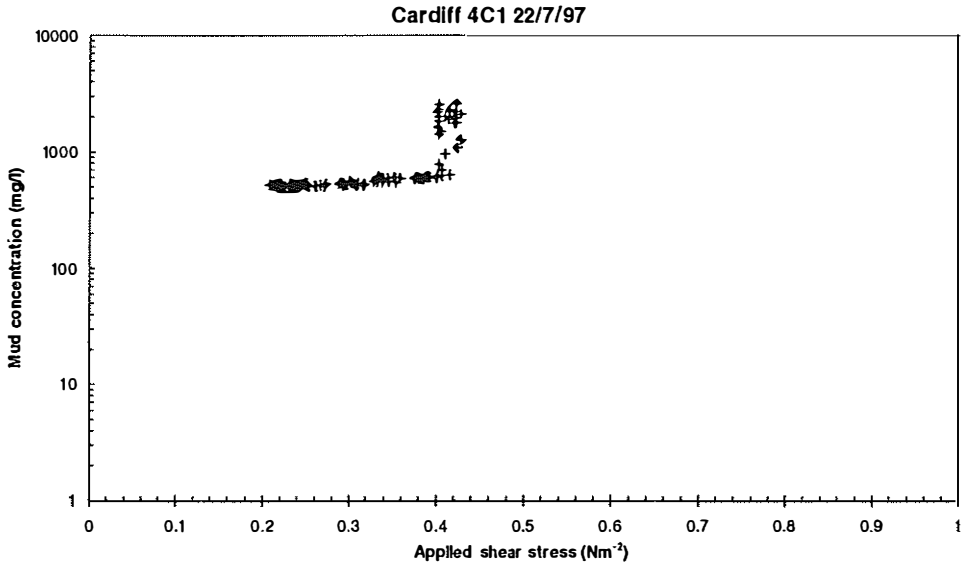


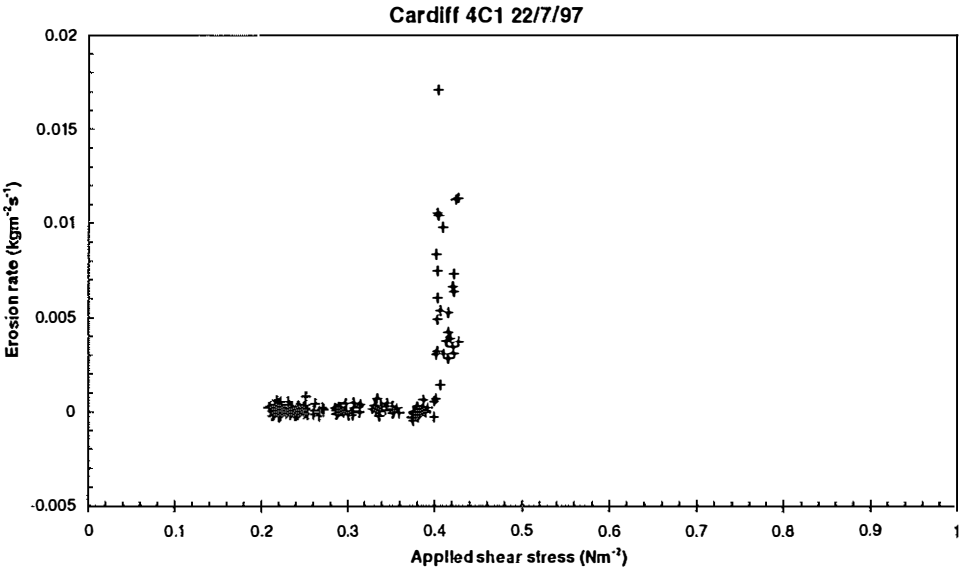

**Site:** **Cardiff seasonal survey July 1997**
Time: 15:51
Date: 22/07/97
Operator: H.J.Mitchener

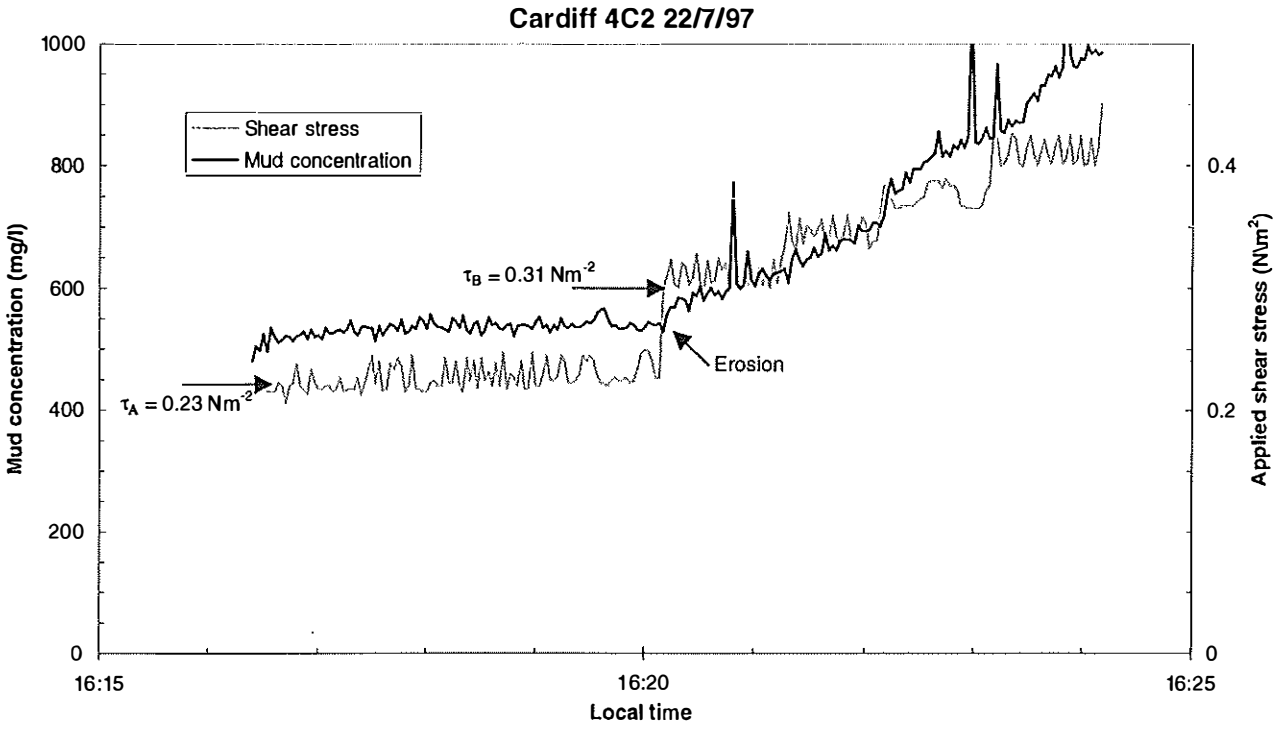
**Photographs:** Time: 15:50

Film: 1
Number: 16


Cardiff 4C1 22/7/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 4C1 22/7/97
Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 4C1 22/7/97
Erosion rate (kgm-2s-1)
0.02
0.015
0.01
0.005
0
-0.005
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey May 1997**
Time: 16:15
Date: 22/07/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjul\cjul005.l01

**Site description:**
texture: medium soft
colour: pale brown
covering: very scant water
topography: ± 2mm, worm tracks, hydrobia
biologically activity: no hydrobia, 15 worms/10cm dia
composition: mud, worms, hydrobia snails
other features: 2nd attempt. Moved to side of dip into runnel - appears harder

**Surface sample:** (from top 5mm) - SM13-15

| | | |
|---|---|---|
| Water content: | 184 | % of dry weight |
| Bulk density: | 1287 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.59 | % by weight |
| Median size d50: | 1.8 | microns |
| Sand content: | 2.2 | % by weight |
| Silt content: | 45.9 | % by weight |
| Clay content: | 51.9 | % by weight |
| Mud Temperature: | 27 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.8
0.3
0.8
0.5
0.2
Average: 0.5

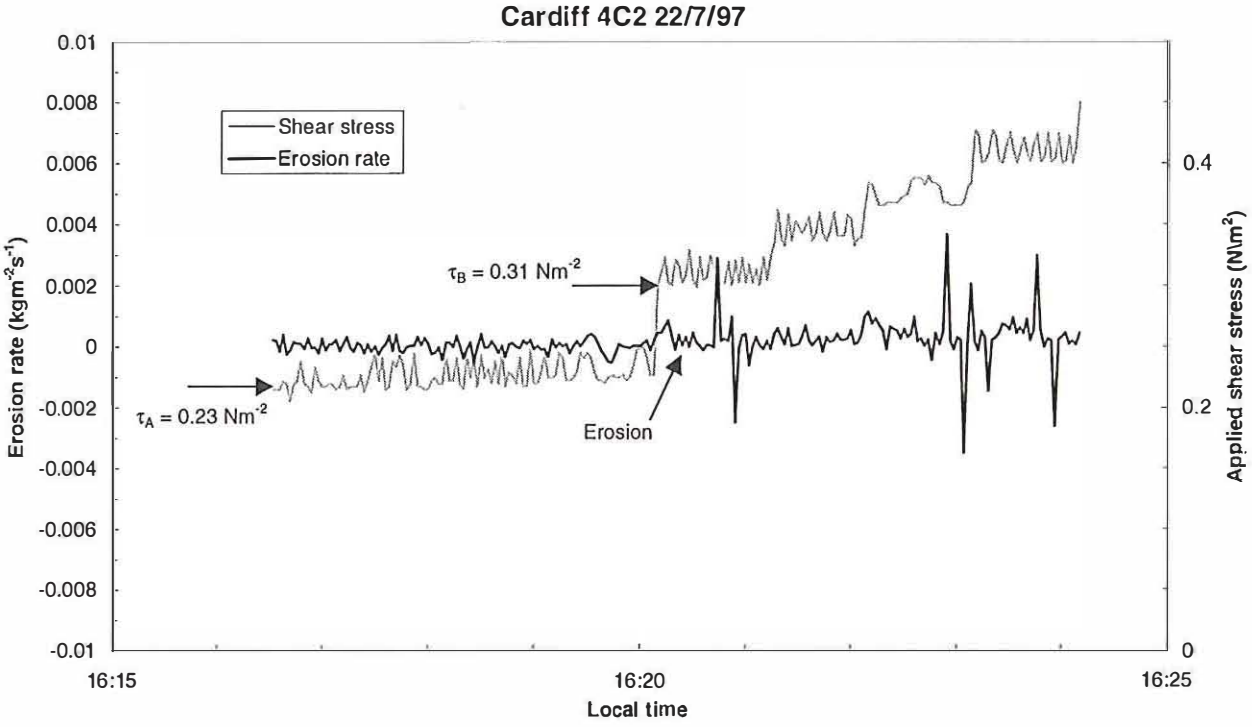
**Eroding Water:** (local collected at HW)
Salinity : 24.34

**Photographs:** Film: 1
Time: 16:13 Number: 18

**Comments:**

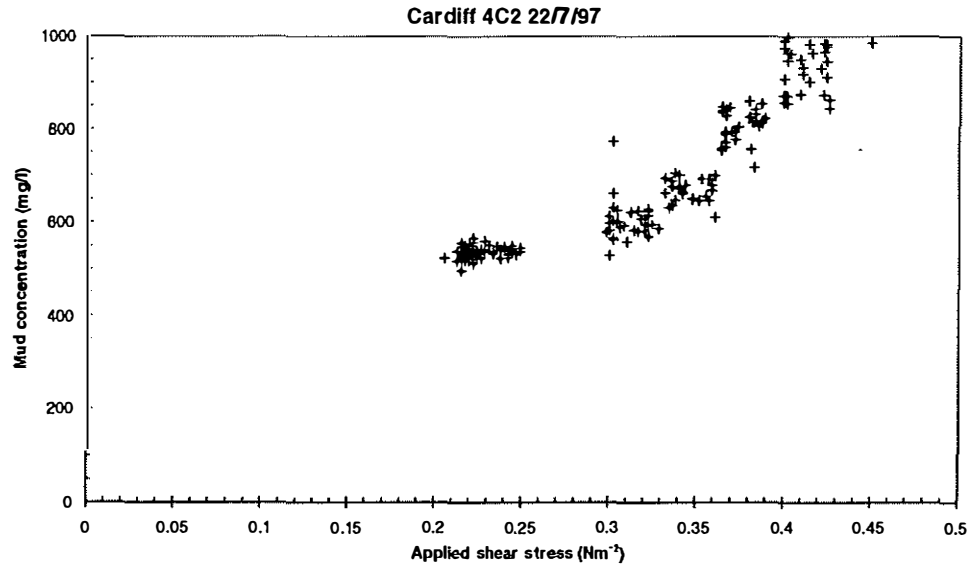
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

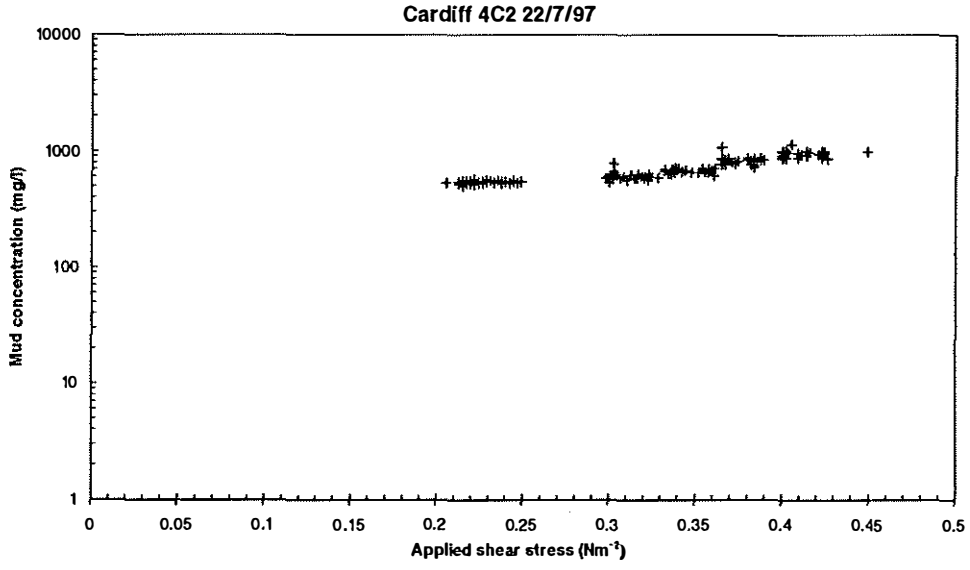
| | | |
|---|---|---|
| $\tau_A$ = | **0.23** | **Nm$^{-2}$** |
| $\tau_B$ = | **0.31** | **Nm$^{-2}$** |
| Average = | **0.27** | **Nm$^{-2}$** |

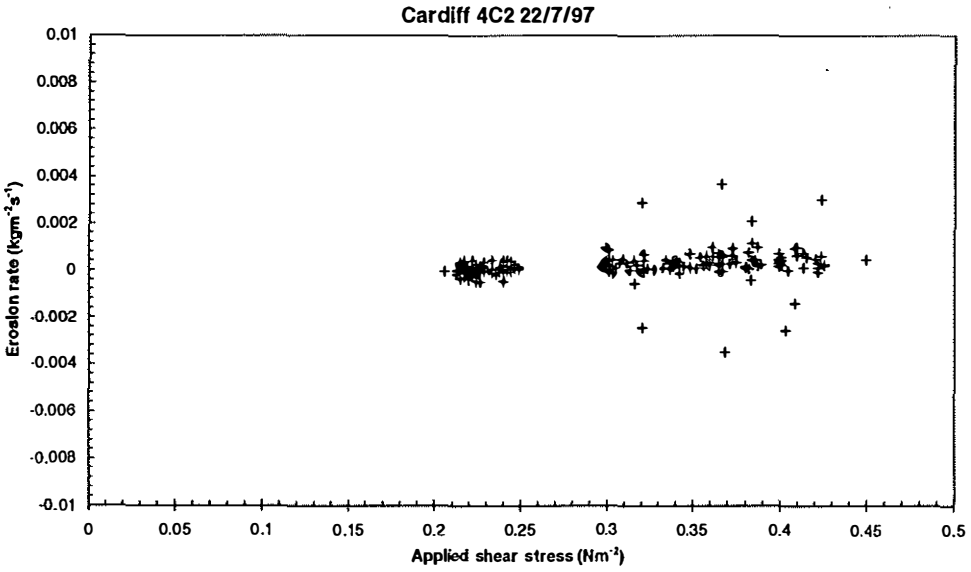


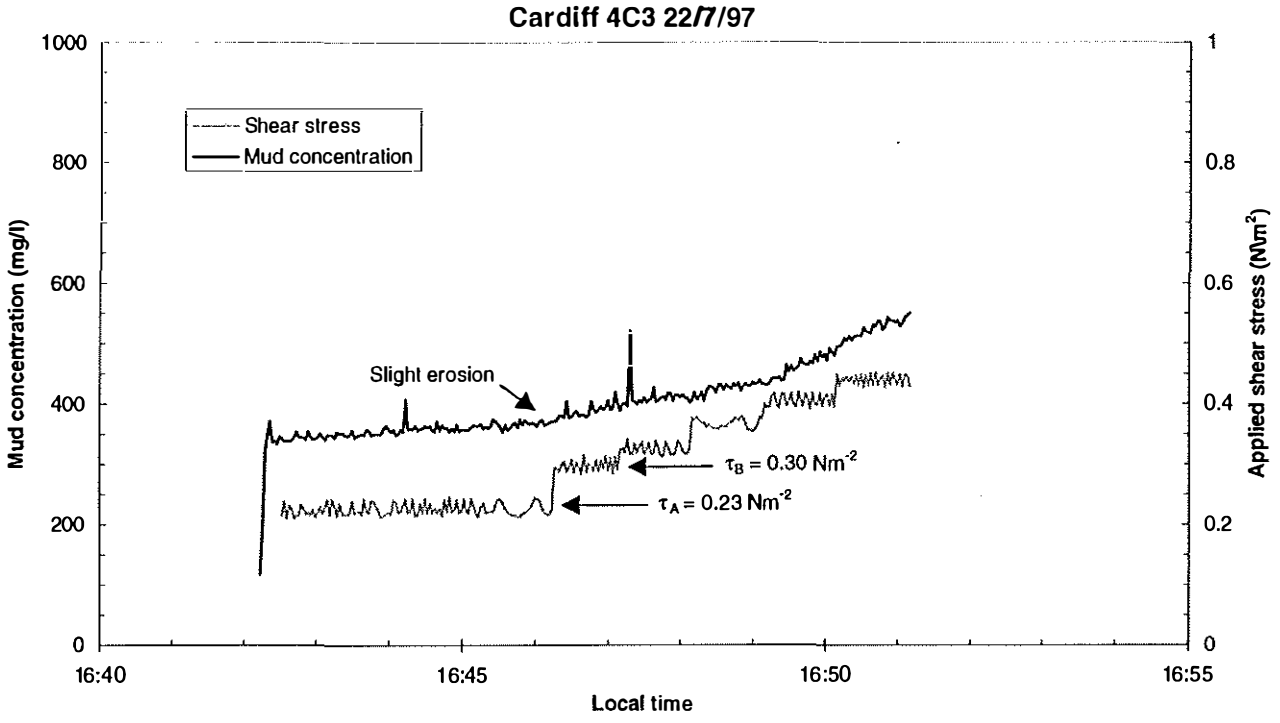

**Site:** **Cardiff seasonal survey July 1997**
Time: 16:15
Date: 22/07/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 16:13 Number: 18


Cardiff 4C2 22/7/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Applied shear stress (Nm-2)


Cardiff 4C2 22/7/97
Mud concentration (mg/l)
10000
1000
100
10
1
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Applied shear stress (Nm-2)


Cardiff 4C2 22/7/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey May 1997**
Time: 16:40
Date: 22/07/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjul\cjul006.l01

**Site description:**
texture: medium
colour: mid brown
covering: worm tracks, pits, dry
topography: ± 2mm, tracks
biologically activity: no hydrobia, 15 worms/10cm dia
composition: mud, worms
other features: 30 worm holes/10cm diam. Slight drainage

**Surface sample:** (from top 5mm) - SM16-18

| | | |
|---|---|---|
| Water content: | 131 | % of dry weight |
| Bulk density: | 1370 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.16 | % by weight |
| Median size d50: | 2.0 | microns |
| Sand content: | 0.9 | % by weight |
| Silt content: | 49.5 | % by weight |
| Clay content: | 49.6 | % by weight |
| Mud Temperature: | 27 | $^0$C |

**Shear vane:** 33mm vane
Observer: Helen Mitchener
Measurements (kPa): 0.8
1.3
1.2
0.9
1.1
Average: 1.1

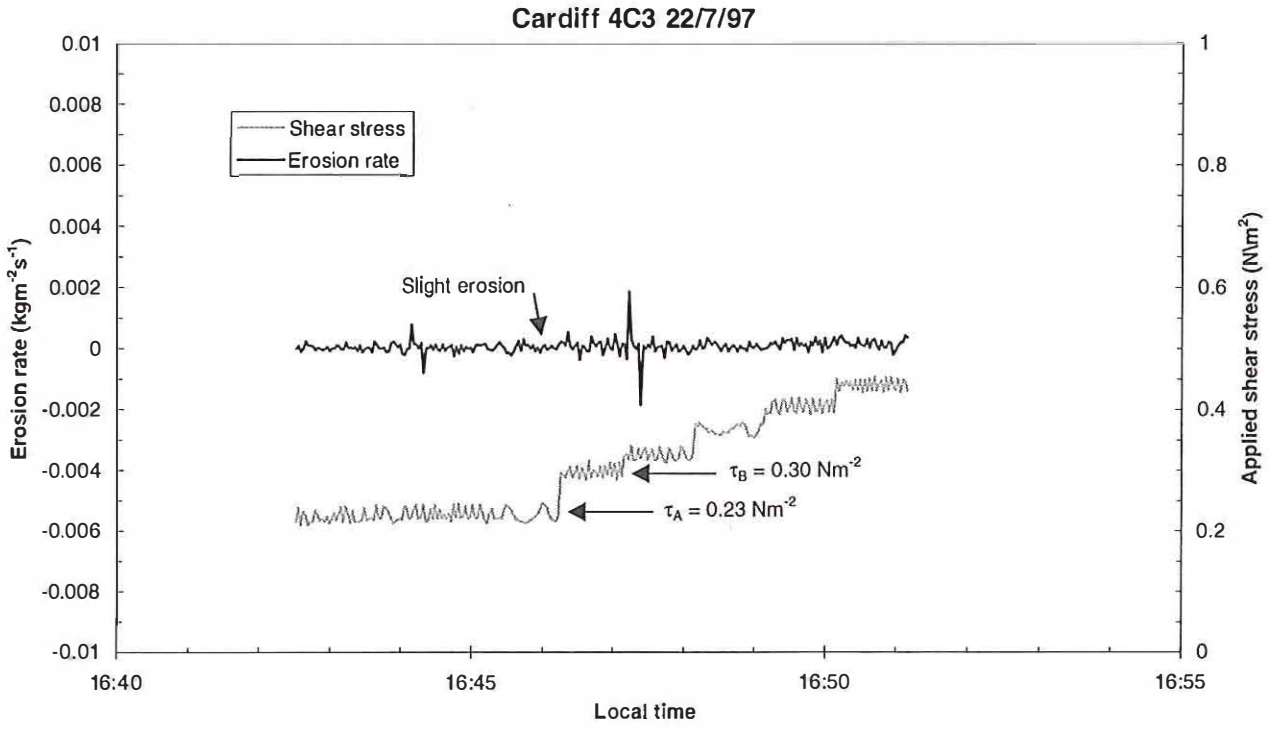
**Eroding Water:** (local collected at HW)
Salinity : 24.34

**Photographs:**
Time: 16:39
Film: 1
Number: 20

**Comments:**

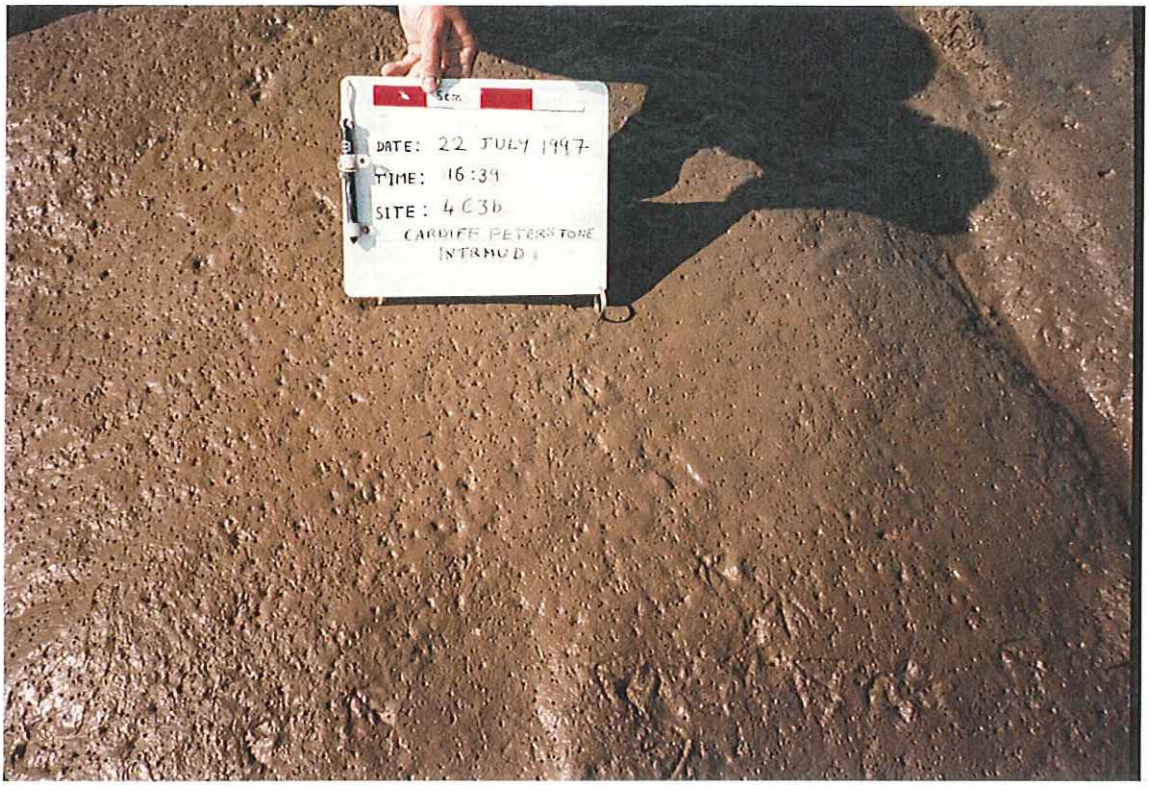
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

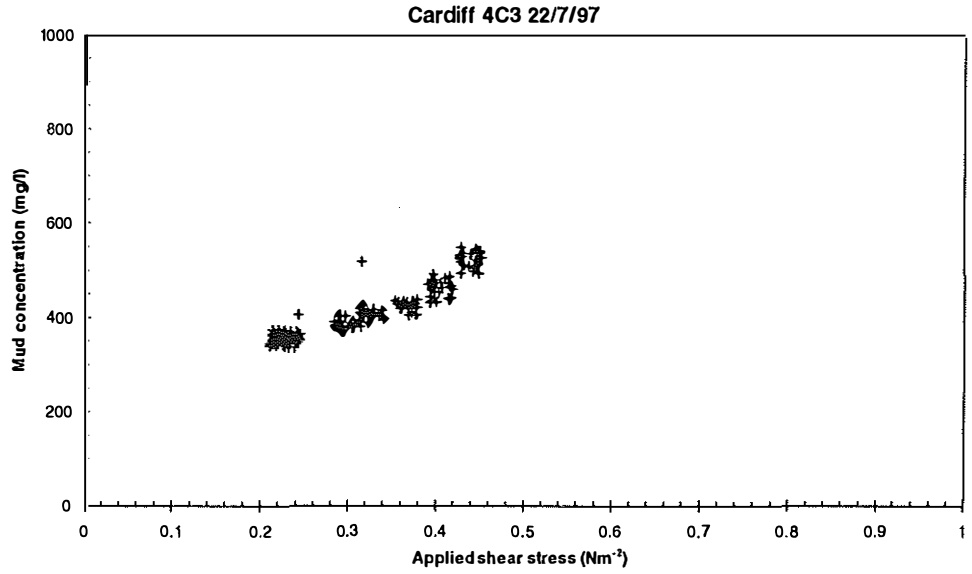
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.23** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.30** | **Nm$^{-2}$** |
| **Average =** | **0.26** | **Nm$^{-2}$** |

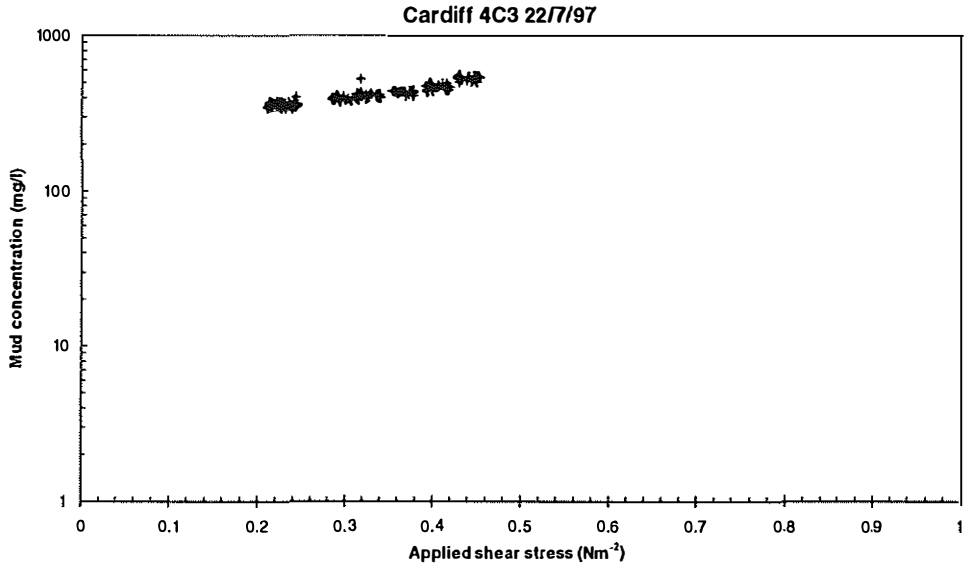


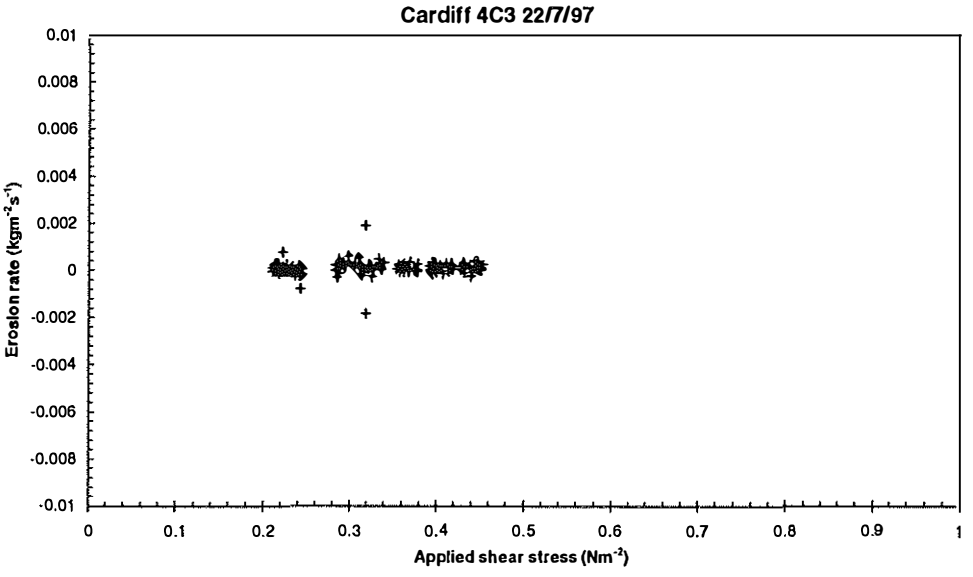

**Site:** **Cardiff seasonal survey July 1997**
Time: 16:40
Date: 22/07/97
Operator: H.J.Mitchener

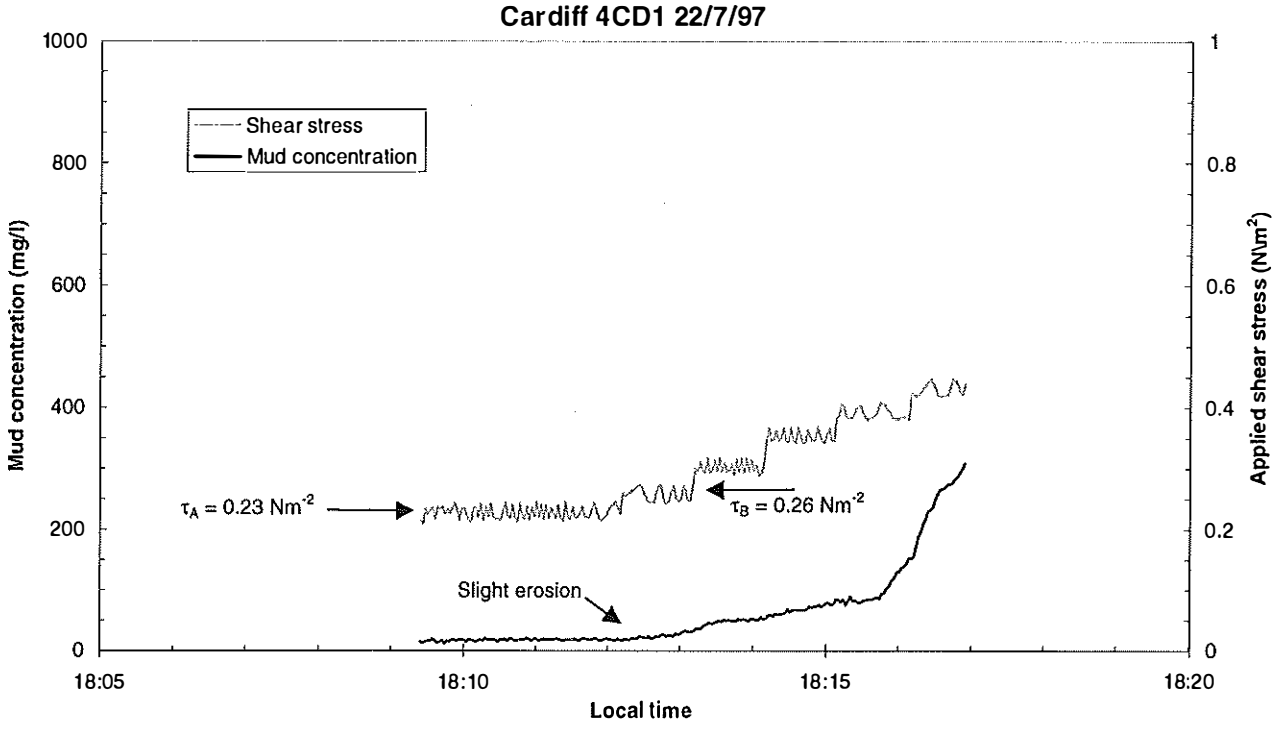
**Photographs:** Time: 16:39
Film: 1
Number: 20




Cardiff 4C3 22/7/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 4C3 22/7/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Cardiff 4C3 22/7/97
Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey July 1997**
Time: 18:05
Date: 22/07/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjul\cjul011.l01

**Site description:**
texture: very hard
colour: mid brown
covering: many worm holes
topography: ± 3mm
biologically activity: ~ 30 worm holes/ 10cm diam. No hydrobia
composition: mud, worms
other features: 7th attempt on flat part

**Surface sample:** (from top 5mm) - SM25-27

| | | |
|---|---|---|
| Water content: | 123 | % of dry weight |
| Bulk density: | 1388 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 8.52 | % by weight |
| Median size d50: | 3.4 | microns |
| Sand content: | 1.8 | % by weight |
| Silt content: | 62.9 | % by weight |
| Clay content: | 35.3 | % by weight |
| Mud Temperature: | 27 | $^0$C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.8
1.8
1.9
2.1
1.9
Average: 1.9

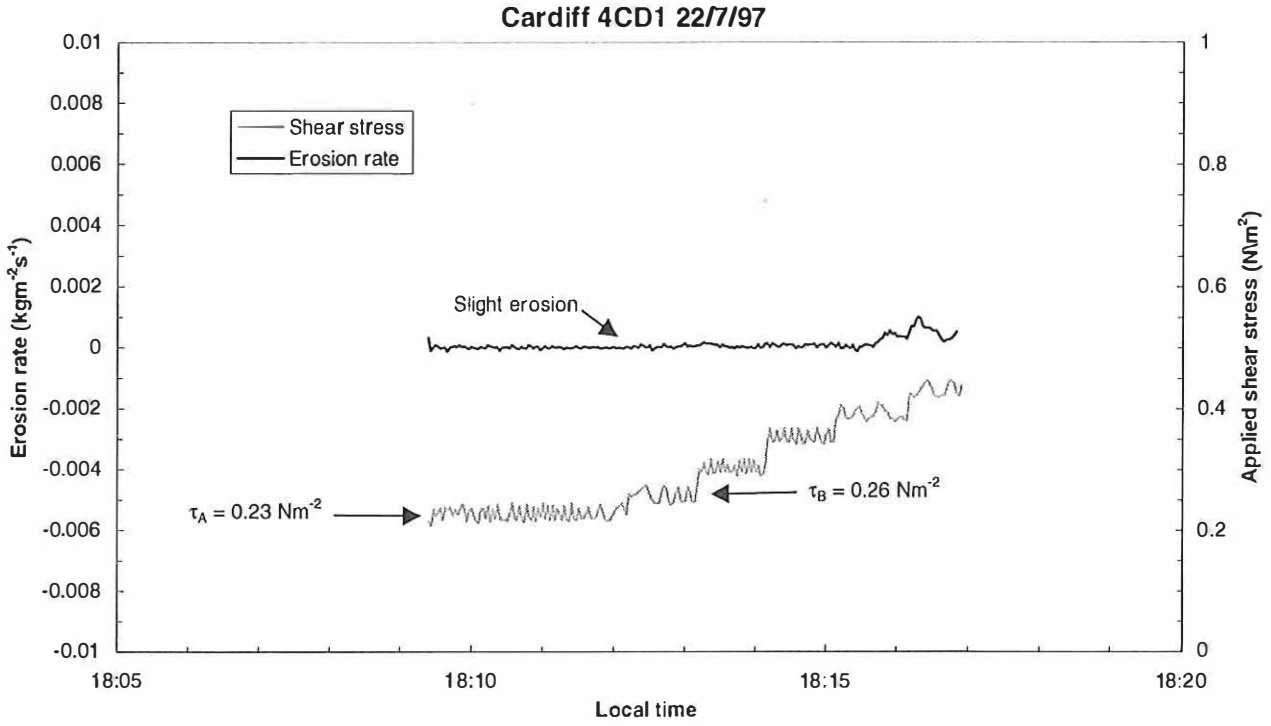
**Eroding Water:** (local collected at HW)
Salinity : 24.34

**Photographs:** Film: 1
Time: 15:28 Number: 22

**Comments:**

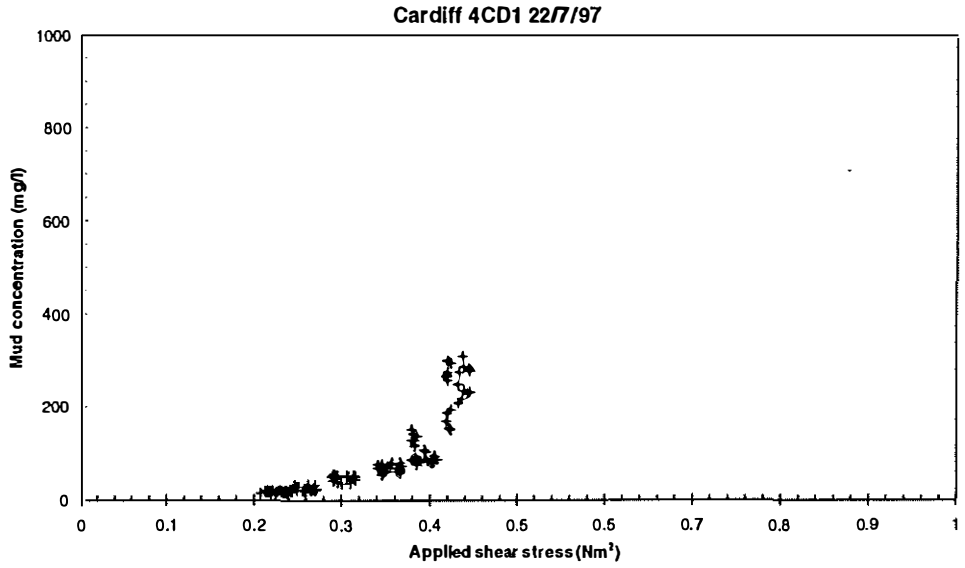
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

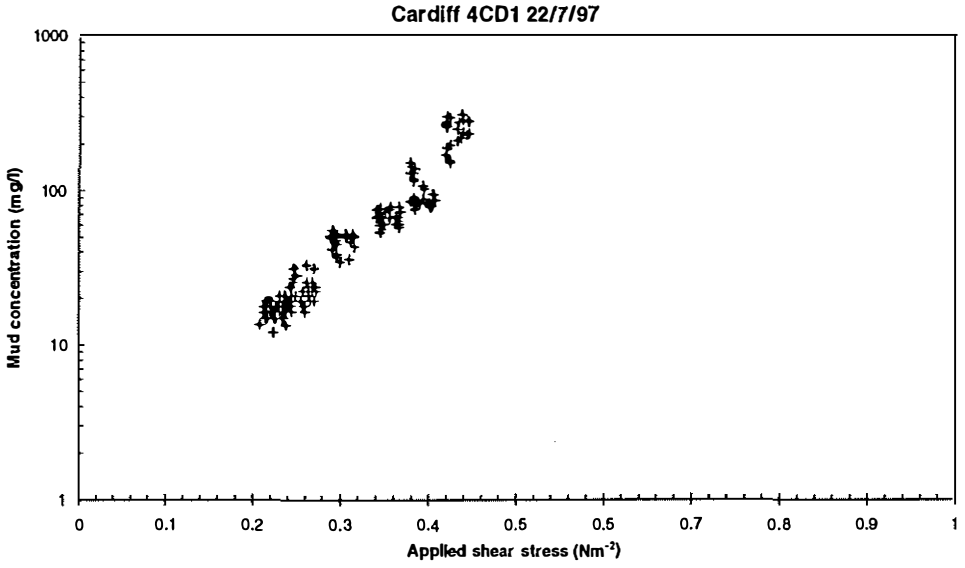
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.23** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.26** | **Nm$^{-2}$** |
| **Average =** | **0.24** | **Nm$^{-2}$** |

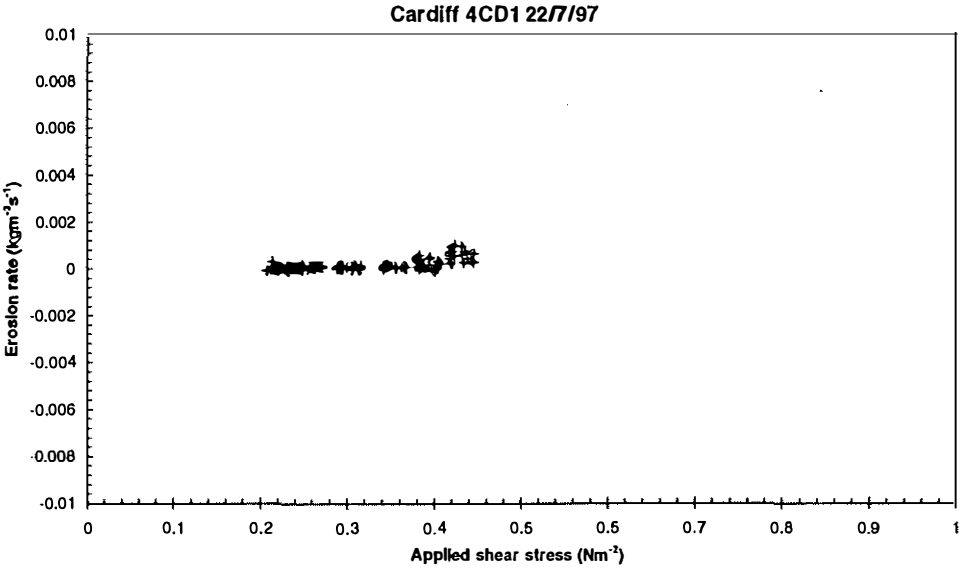



**Site:** **Cardiff seasonal survey July 1997**
Time: 18:05
Date: 22/07/97
Operator: H.J.Mitchener

**Photographs:** Time: 15:28
Film: 1
Number: 22

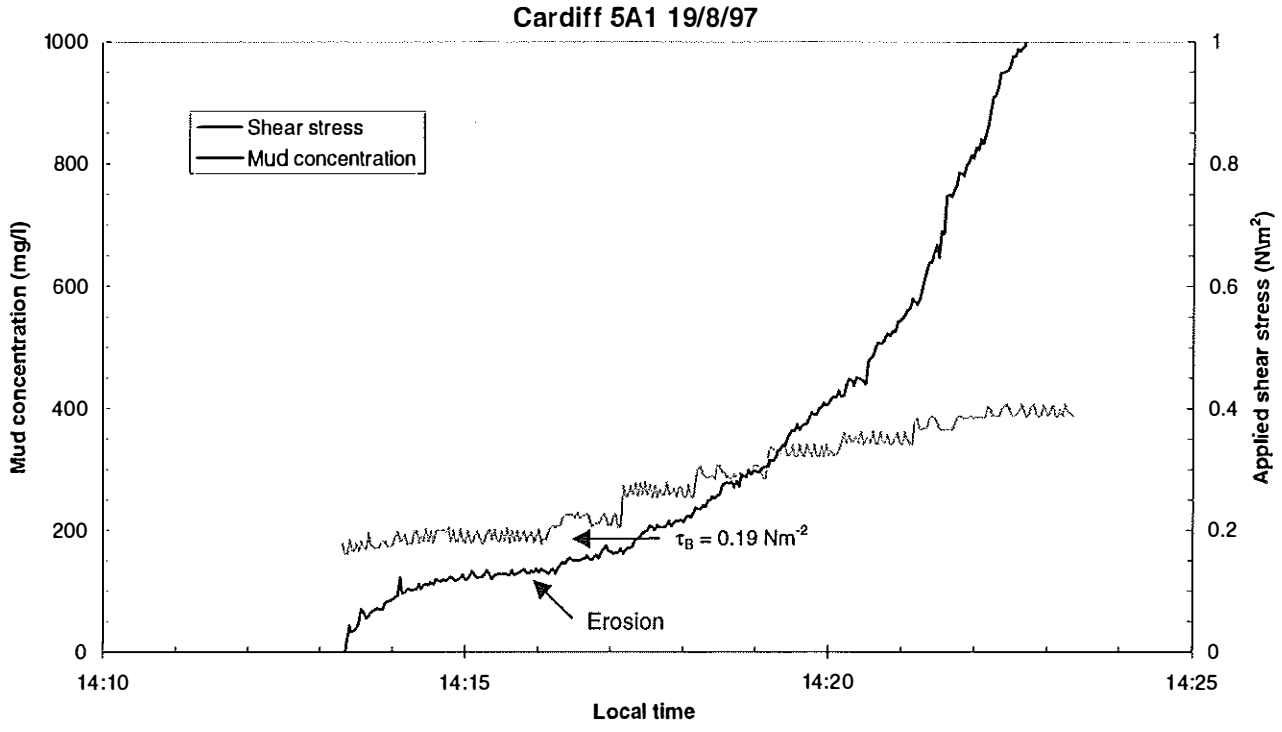

Cardiff 4CD1 22/7/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.5
0.7
0.8
0.9
1
Applied shear stress (Nm²)


Cardiff 4CD1 22/7/97
Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.5
0.7
0.8
0.9
1
Applied shear stress (Nm⁻²)


Cardiff 4CD1 22/7/97
Erosion rate (kgm⁻²s⁻¹)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.5
0.7
0.8
0.9
1
Applied shear stress (Nm⁻²)

# SedErode Data Plots

## Cardiff August 1997




**Site:** **Cardiff seasonal survey August 1997**
Time: 13:37
Date: 19/08/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\caug\caug001.l01

**Site description:**
texture: medium soft
colour: mid brown
covering: hydrobia, water, worms
topography: flat with slightridge, ± 1mm
biologically activity: 15-20 hydrobia & 15-20 worm holes / 10cm diam
composition: mud, no sand, hydrobia
other features: saturated mud draining down. ~5mm very saturated deposit (last tide) over harder layer. ~5m E of drainage channel

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 301 | % of dry weight |
| Bulk density: | 1196 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 10.93 | % by weight |
| Median size d50: | 1.7 | microns |
| Sand content: | 1.1 | % by weight |
| Silt content: | 45.3 | % by weight |
| Clay content: | 53.6 | % by weight |
| Mud Temperature: | 30 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.3, 1.2, 1.2, 1.8, 1.6
Average: 1.4

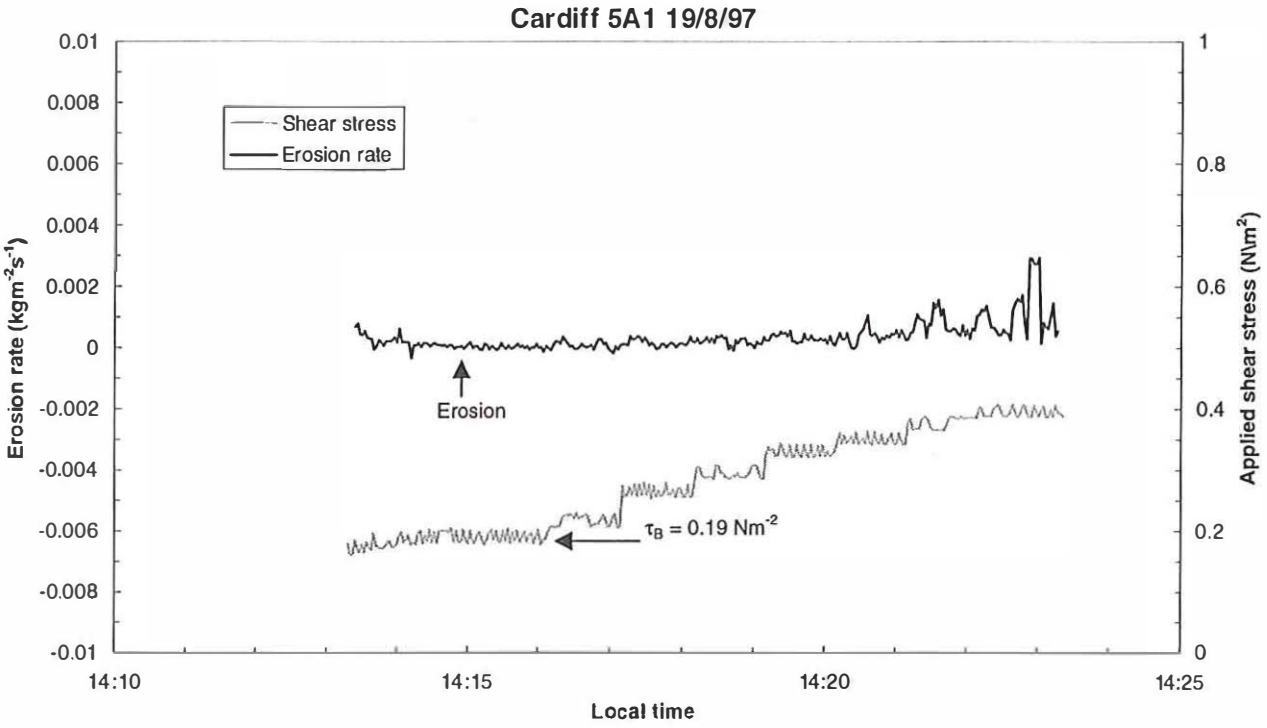
**Eroding Water:** (local collected at HW)
Salinity : 25.63

**Photographs:**
Time: 13:35
Film: 1
Number: 1

**Comments:**

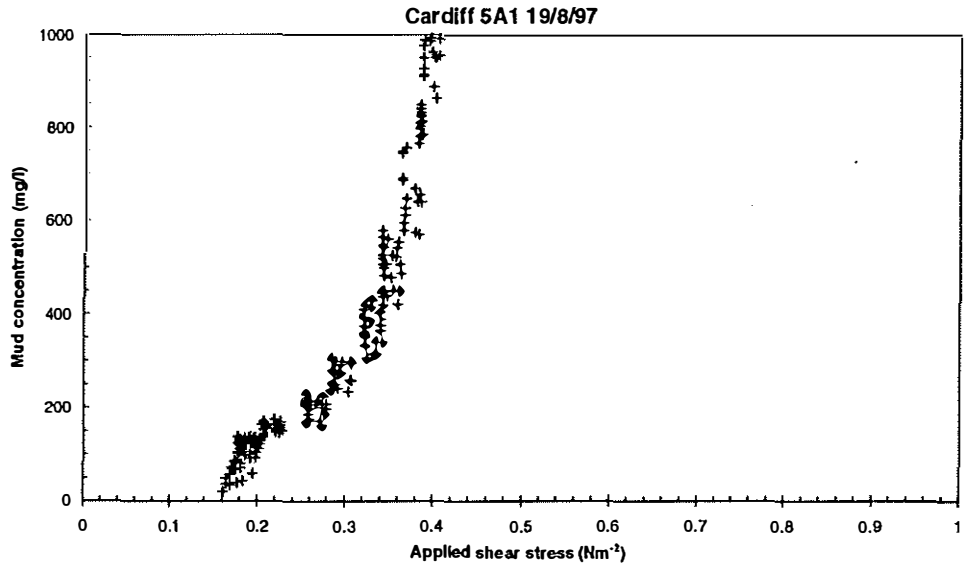
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

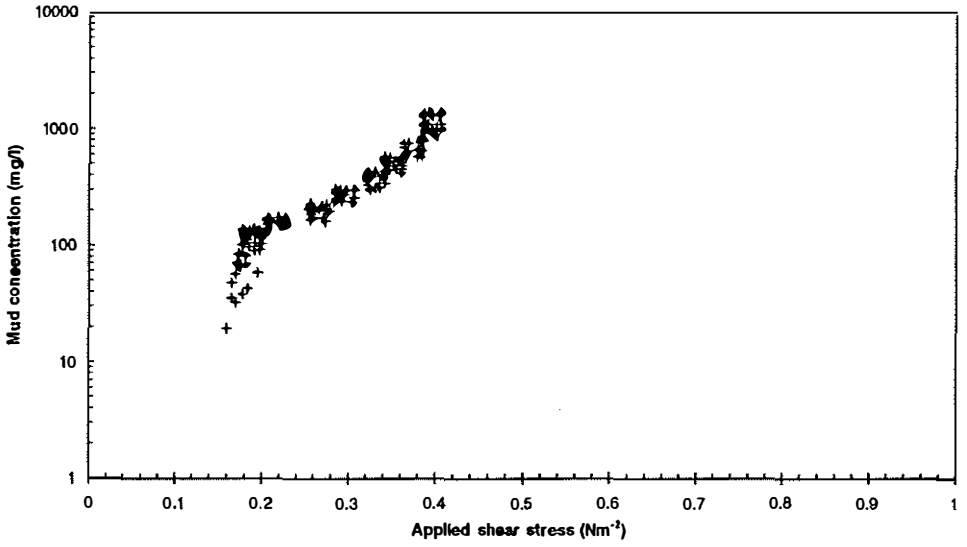
| | | |
|---|---|---|
| $\tau_A$ = | 0.00 | $Nm^{-2}$ |
| $\tau_B$ = | 0.19 | $Nm^{-2}$ |
| **Average =** | **0.10** | $Nm^{-2}$ |

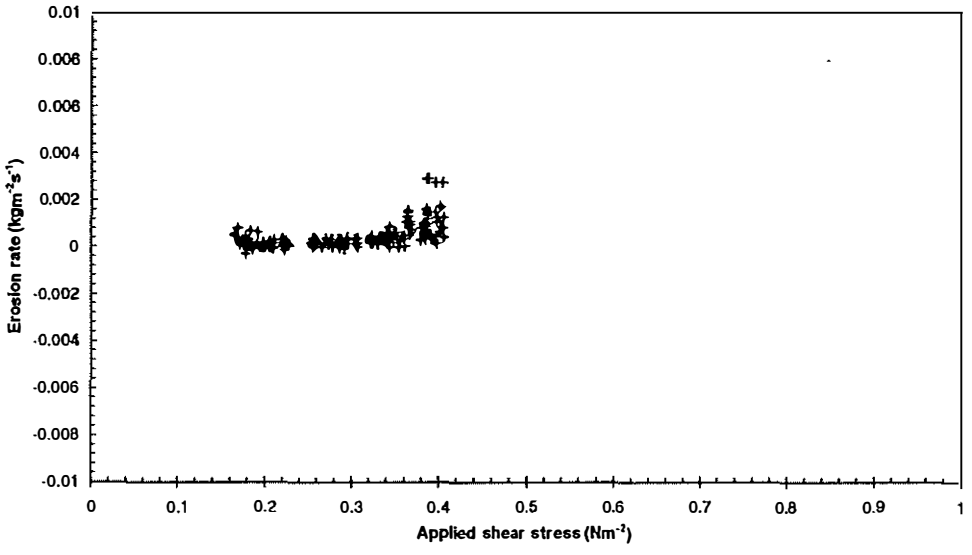



**Site:** **Cardiff seasonal survey August 1997**
Time: 13:37
Date: 19/08/97
Operator: H.J.Mitchener

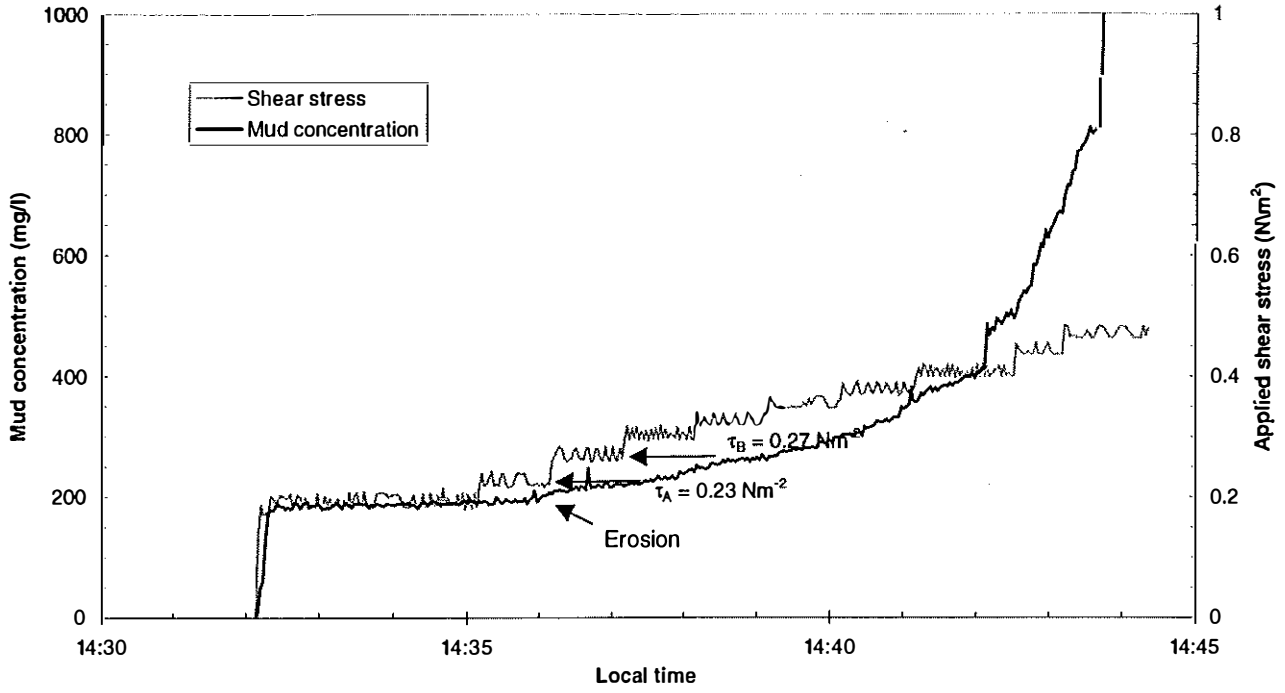
**Photographs:** Time: 13:35
Film: 1
Number: 1


Cardiff 5A1 19/8/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.01
0.006
0.008
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)

## Cardiff 5A2 19/8/97




**Site:** **Cardiff seasonal survey August 1997**
Time: 14:27
Date: 19/08/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\caug\caug002.l01

**Site description:**
texture: medium soft
colour: pale brown
covering: hydrobia 20/10cm, worms 3/10cm, 15-20 worm holes
topography: ± 1mm, flatish, hydrobia on top
biologically activity: hydrobia, worms under surface
composition: mud, no sand
other features: harder surface than A1, on ridge top
soft layer. Dry, humid, very warm

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 247 | % of dry weight |
| Bulk density: | 1228 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 11.15 | % by weight |
| Median size d50: | 3.6 | microns |
| Sand content: | 1.3 | % by weight |
| Silt content: | 70.2 | % by weight |
| Clay content: | 28.5 | % by weight |
| Mud Temperature: | 29 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.1
1.3
1.4
1.6
1.4
Average: 1.4

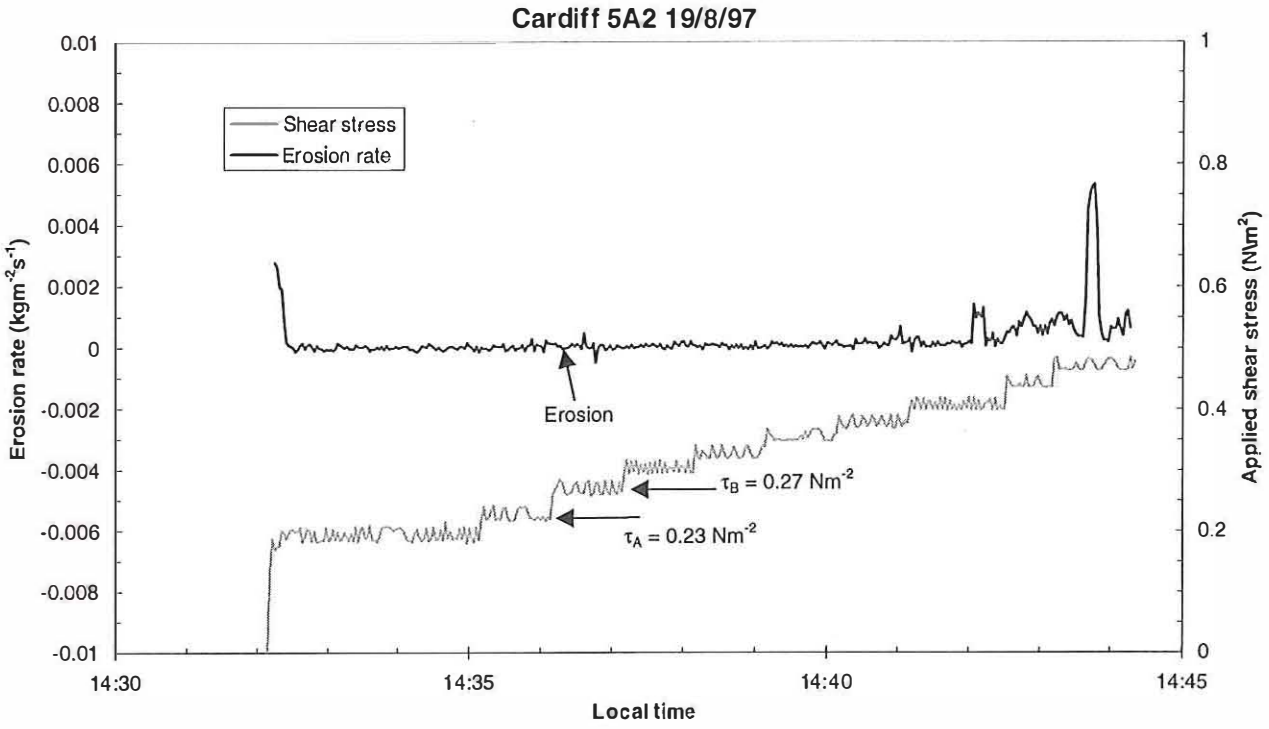
**Eroding Water:** (local collected at HW)
Salinity : 25.63

**Photographs:** Film: 1
Time: 14:25 Number: 2
Time: Number: 4

**Comments:**

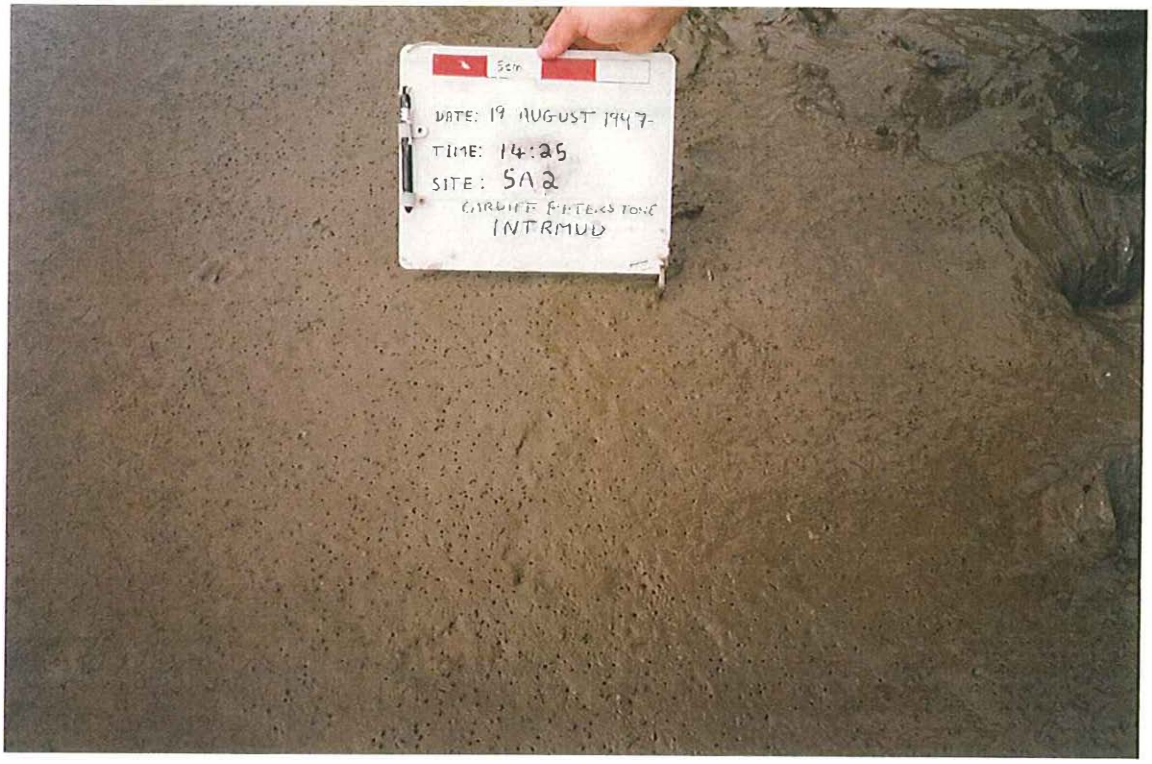
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

| | | |
|---|---|---|
| $\tau_A$ = | **0.23** | **Nm$^{-2}$** |
| $\tau_B$ = | **0.27** | **Nm$^{-2}$** |
| **Average =** | **0.25** | **Nm$^{-2}$** |

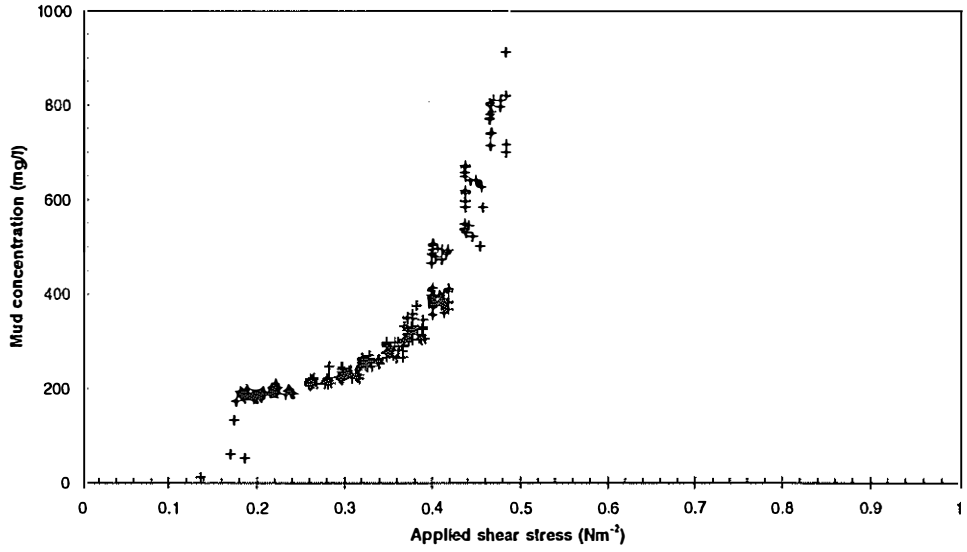


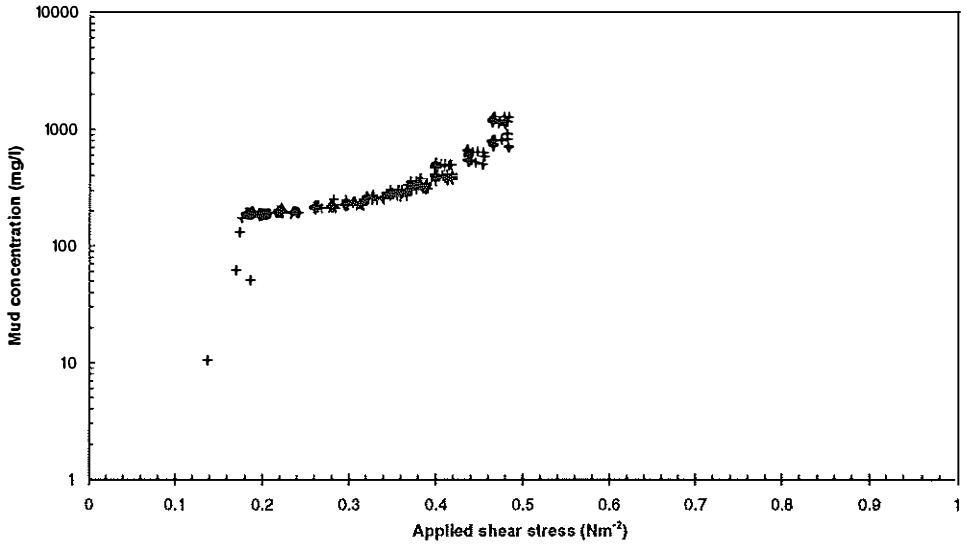

**Site:** **Cardiff seasonal survey August 1997**
Time: 14:27
Date: 19/08/97
Operator: H.J.Mitchener

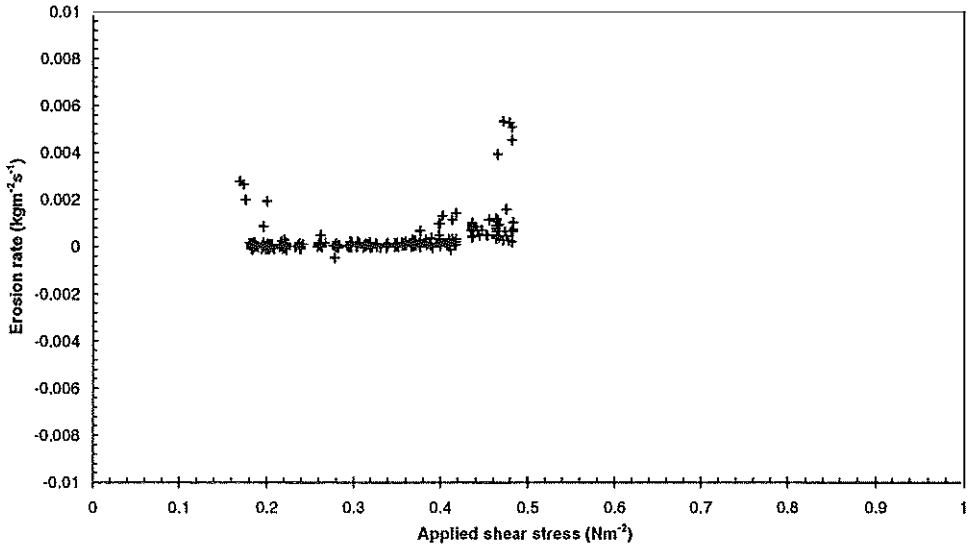
**Photographs:** Film: 1
Time: 14:25 Number: 2
Time: Number: 4

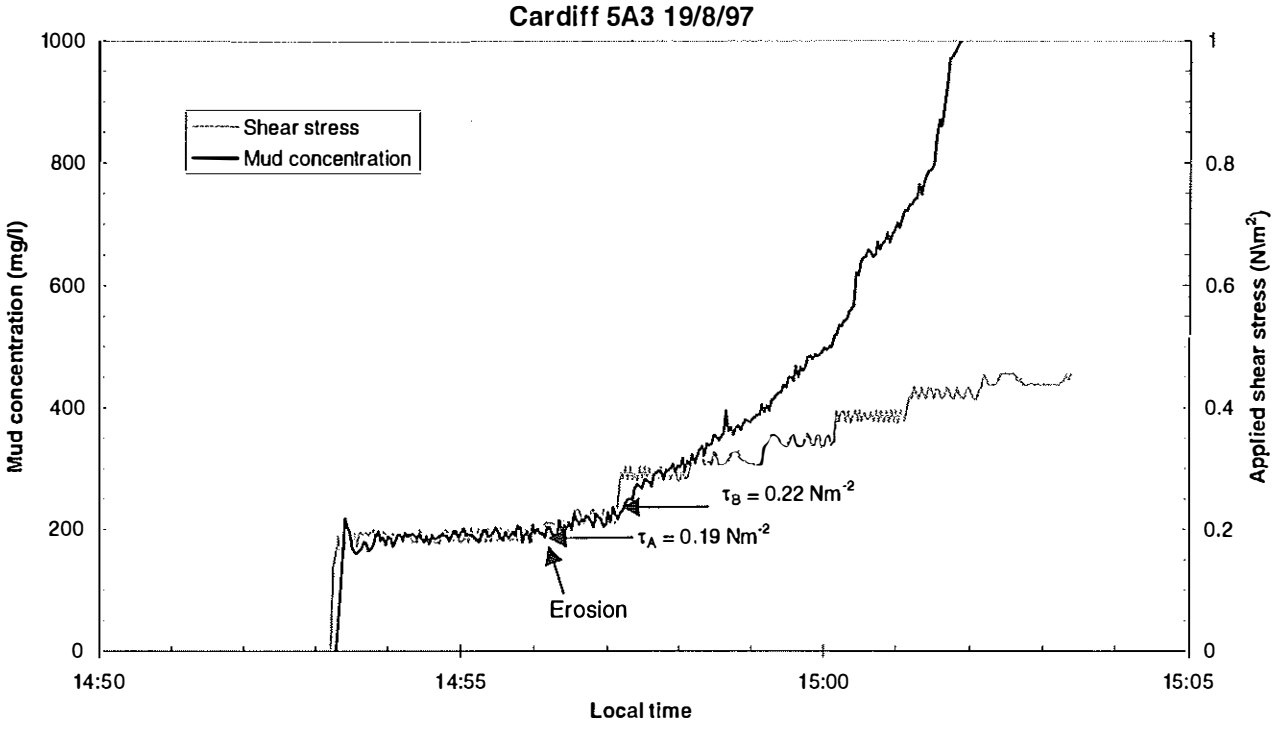


## Cardiff 5A2 19/8/97






**Site:** **Cardiff seasonal survey August 1997**
Time: 14:51
Date: 19/08/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\caug\caug003.l01

**Site description:**
texture: v. soft top layer, medium soft
colour: pale brown
covering: hydrobia 20/10cm, worms ~10/10cmdlam
topography: ± 1mm, hydrobia on flat mud
biologically activity: hydrobia
composition: mud
other features: soft mud. ~2m from a1 & A2

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 289 | % of dry weight |
| Bulk density: | 1202 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 14.40 | % by weight |
| Median size d50: | 3.7 | microns |
| Sand content: | 1.5 | % by weight |
| Silt content: | 68.9 | % by weight |
| Clay content: | 29.6 | % by weight |
| Mud Temperature: | 30 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.1
1.0
1.0
1.1
1.3
Average: 1.1

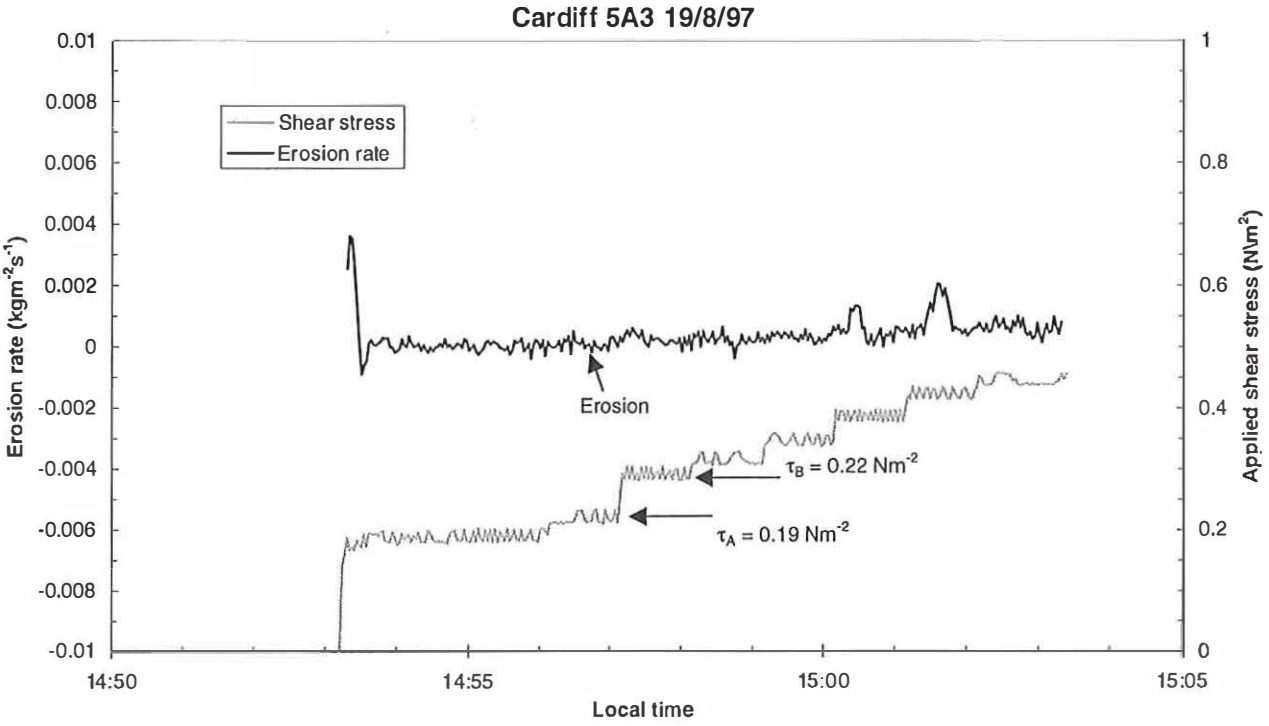
**Eroding Water:** (local collected at HW)
Salinity : 25.63

**Photographs:**
Film: 1
Number: 3

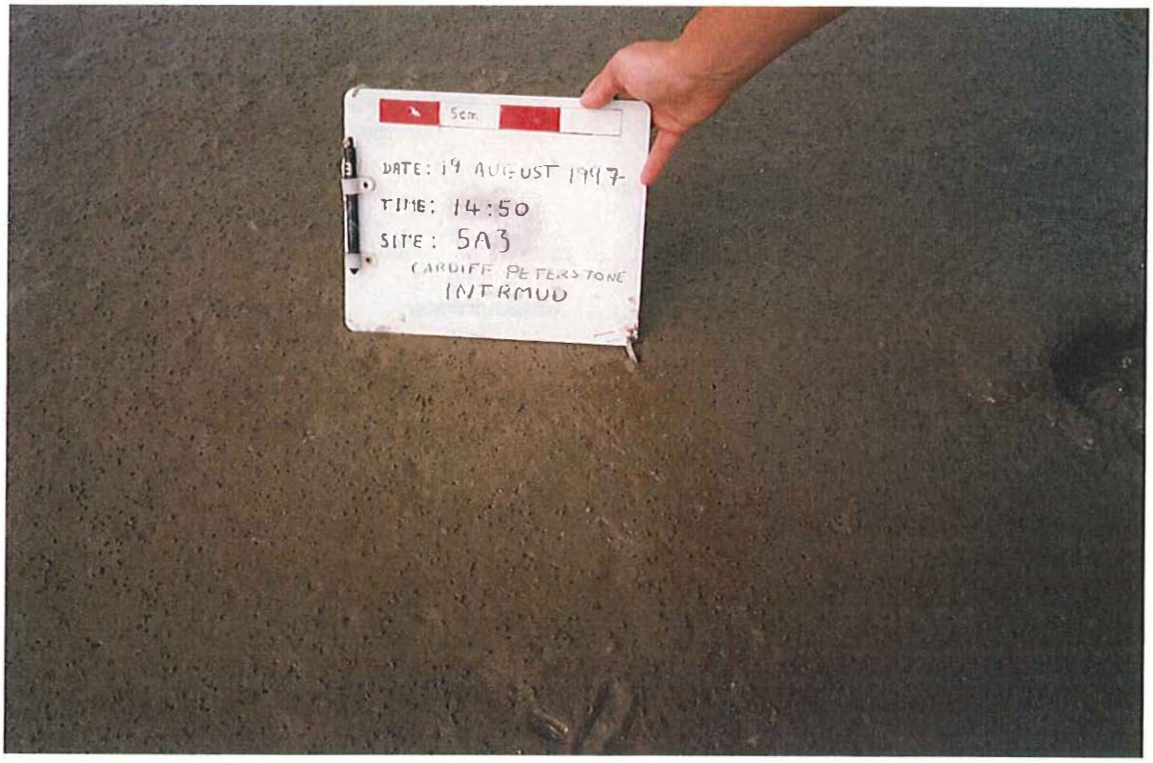
**Comments:**

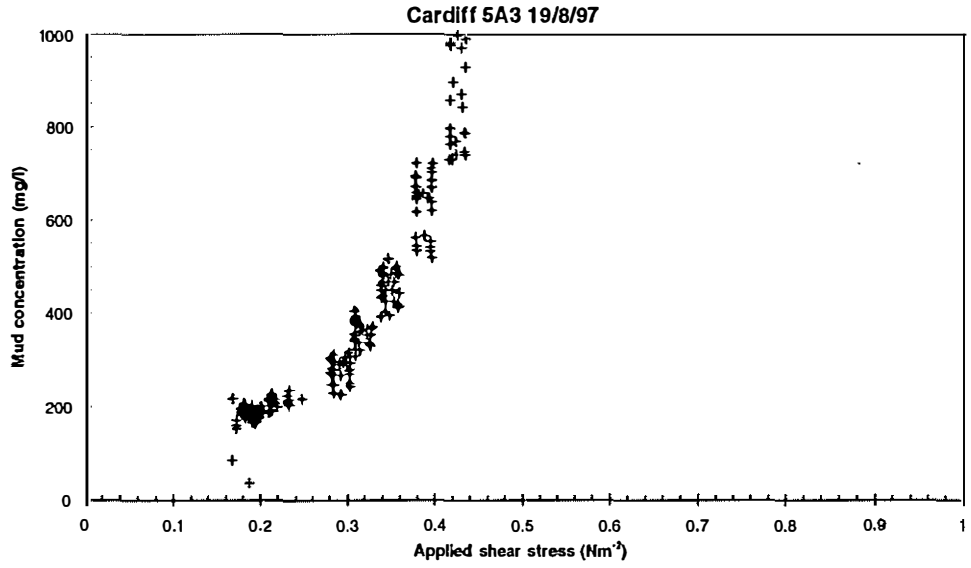
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

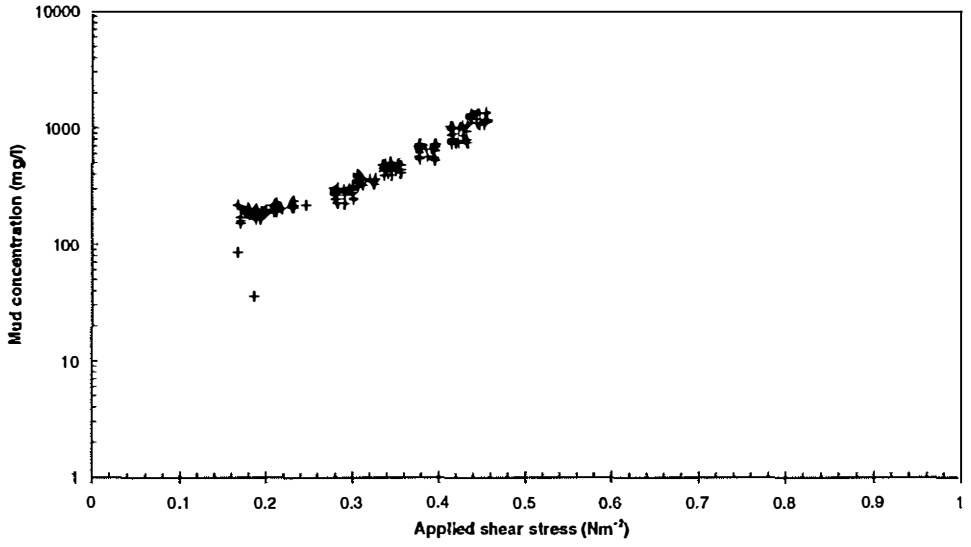
| | | |
|---|---|---|
| $\tau_A$ = | **0.19** | **$Nm^{-2}$** |
| $\tau_B$ = | **0.22** | **$Nm^{-2}$** |
| **Average** = | **0.21** | **$Nm^{-2}$** |

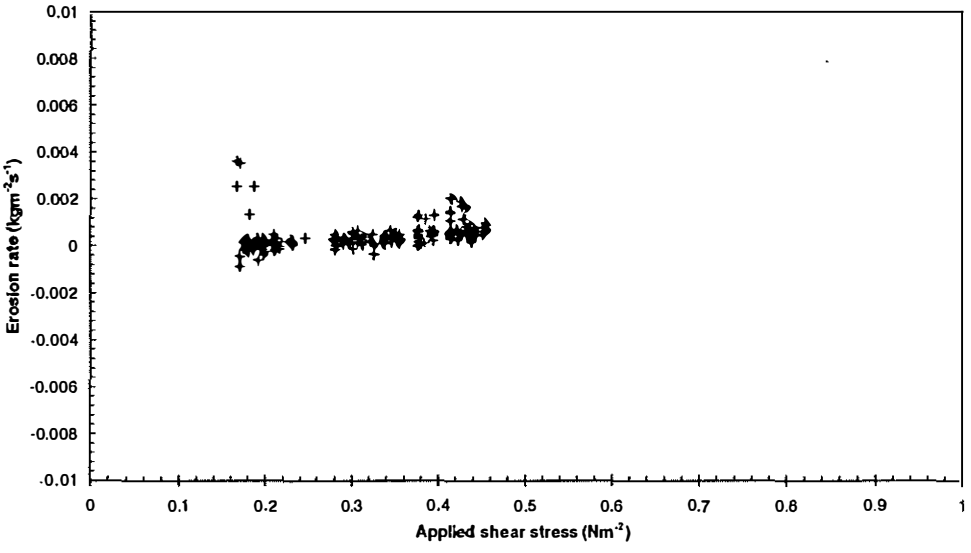


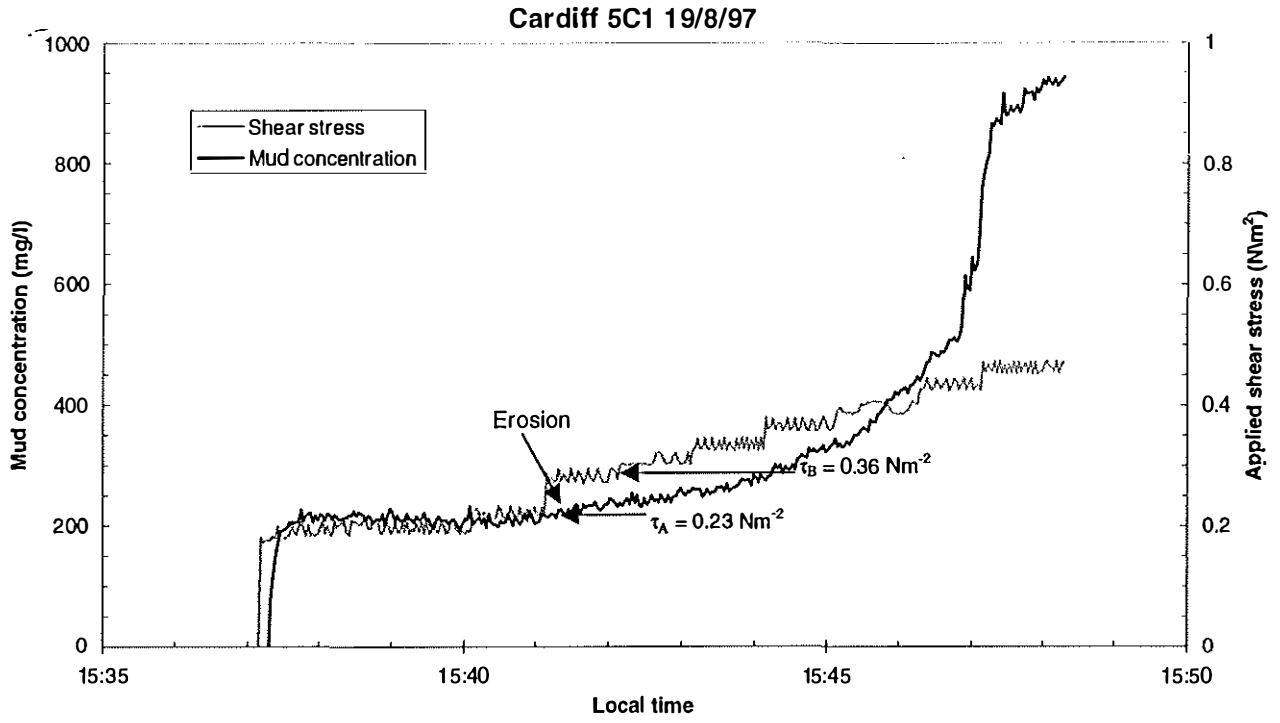

**Site:** **Cardiff seasonal survey August 1997** **Photographs:** Film: 1
Time: 14:51 Number: 3
Date: 19/08/97
Operator: H.J.Mitchener




Cardiff 5A3 19/8/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey August 1997**
Time: 15:30
Date: 19/08/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\caug\caug004.l01

**Site description:**

texture: medium soft - hardish, less water
colour: pale brown
covering: hydrobia, fewworms
topography: ± 1mm on flat ridge
biologically activity: hydrobia ~20/10cm, wormholes ~10/10cmdiam
composition: mud, no sand
other features: audible draining sound
warm, hot, muggy

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 224 | % of dry weight |
| Bulk density: | 1247 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 11.89 | % by weight |
| Median size d50: | 1.9 | microns |
| Sand content: | 0.7 | % by weight |
| Silt content: | 47.9 | % by weight |
| Clay content: | 51.4 | % by weight |
| Mud Temperature: | 29.25 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.5
0.8
0.2
0.7
0.8
Average: 0.6

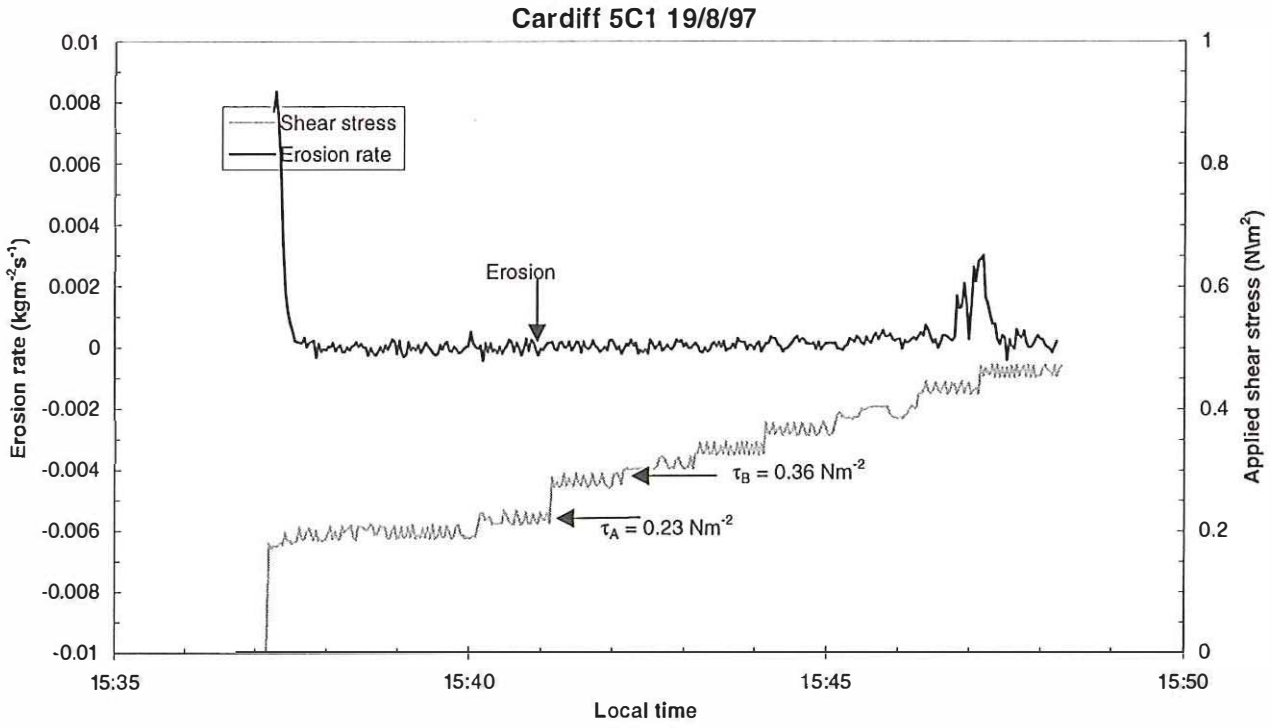
**Eroding Water:** (local collected at HW)
Salinity : 25.63

**Photographs:**
Time: 15:27
Film: 1
Number: 5

**Comments:**

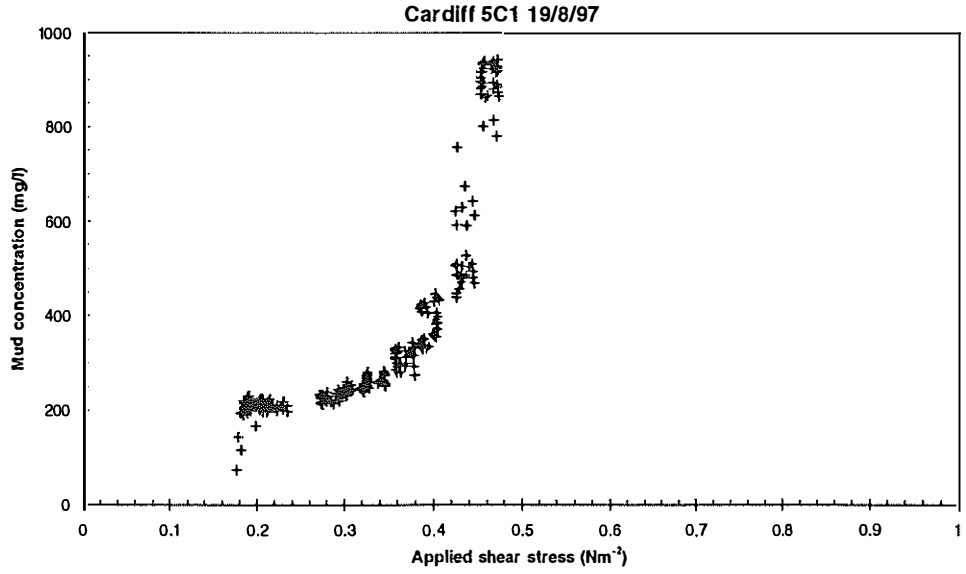
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

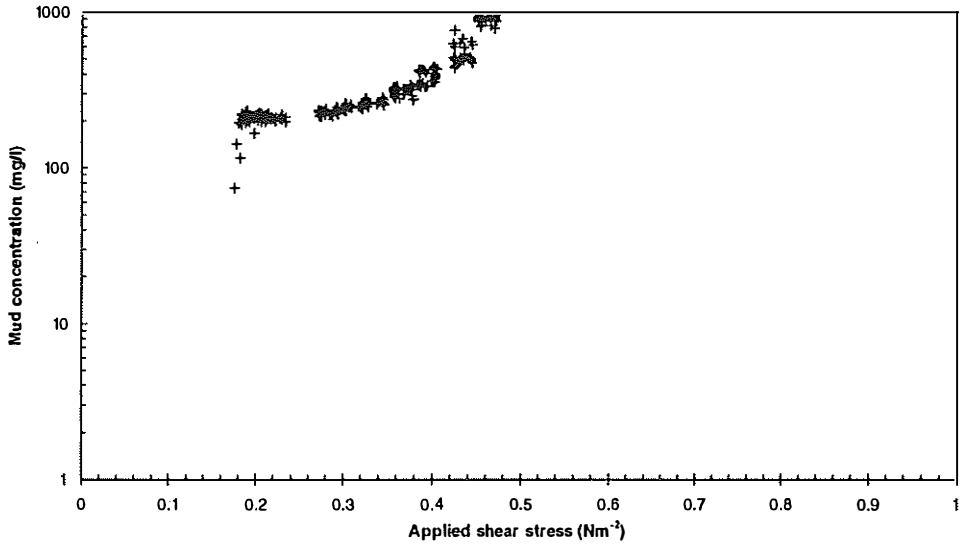
| | | |
|---|---|---|
| $\tau_A$= | **0.23** | Nm$^{-2}$ |
| $\tau_B$= | **0.36** | Nm$^{-2}$ |
| **Average =** | **0.30** | Nm$^{-2}$ |

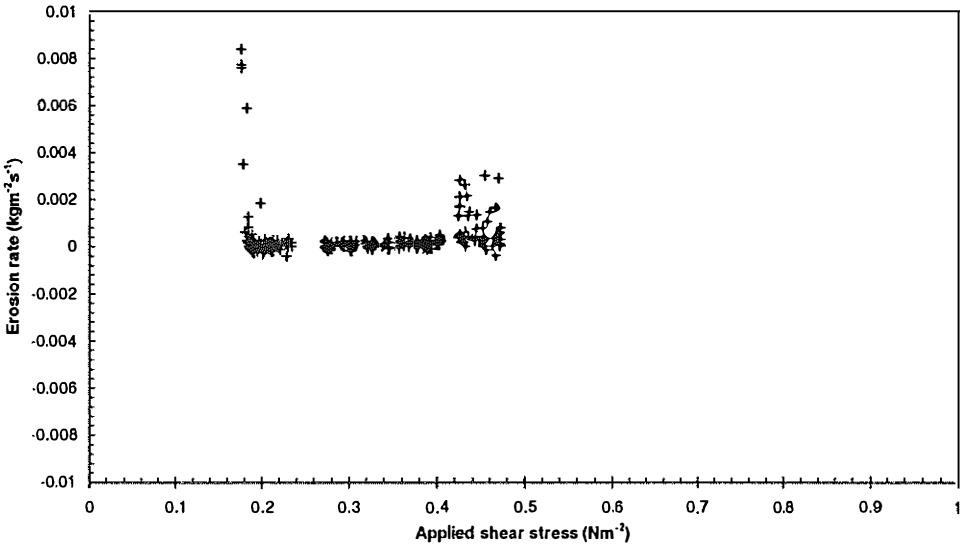


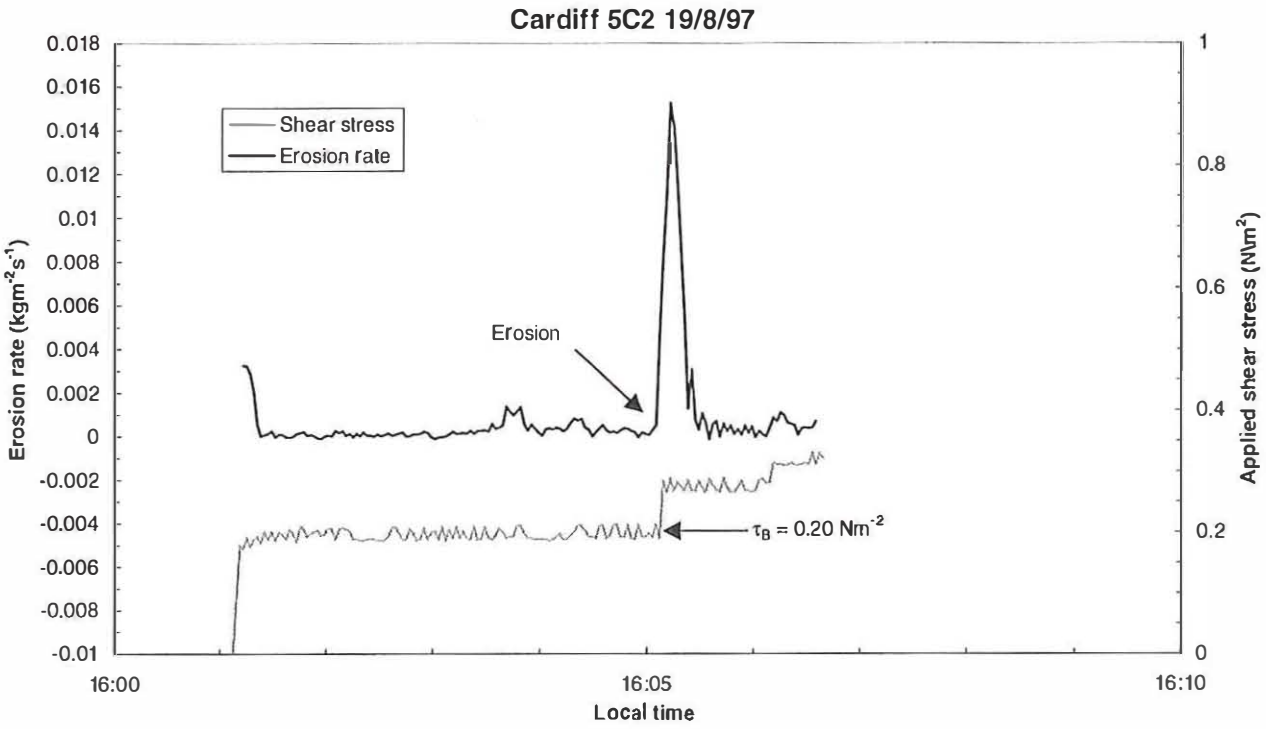

**Site:** **Cardiff seasonal survey August** 1997
Time: 15:30
Date: 19/08/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 15:27 Number: 5


Cardiff 5C1 19/8/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)

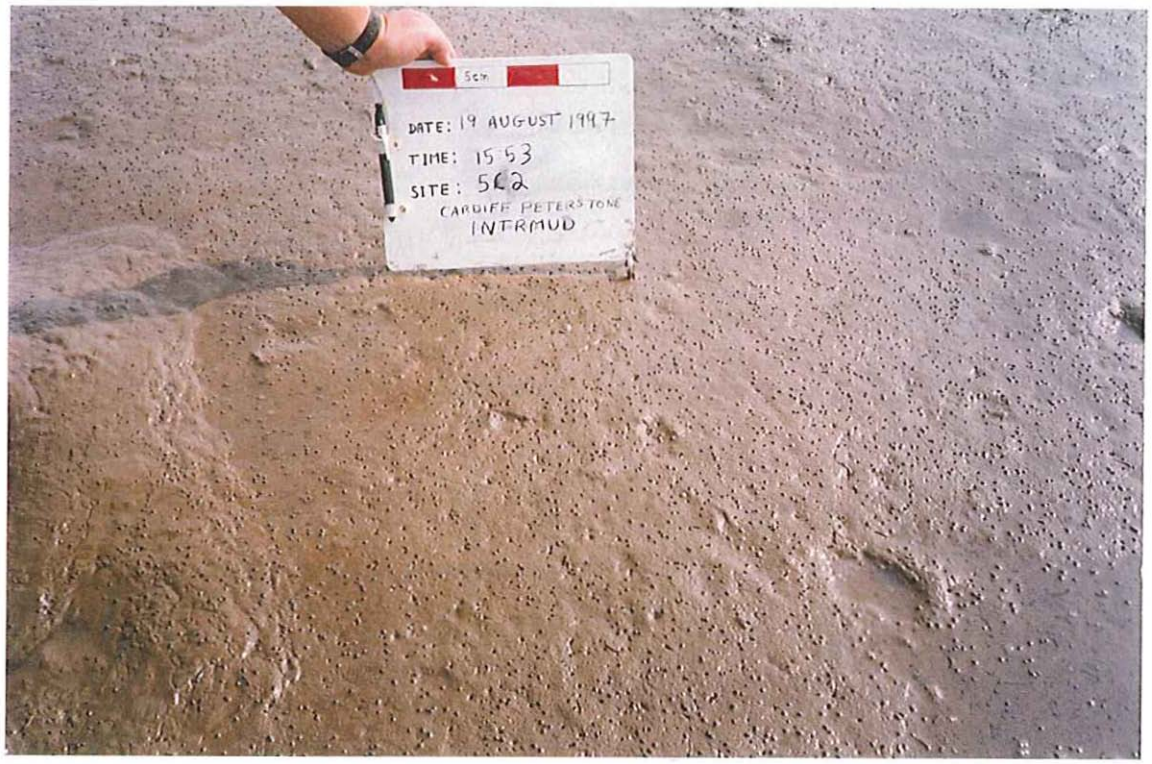

Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)

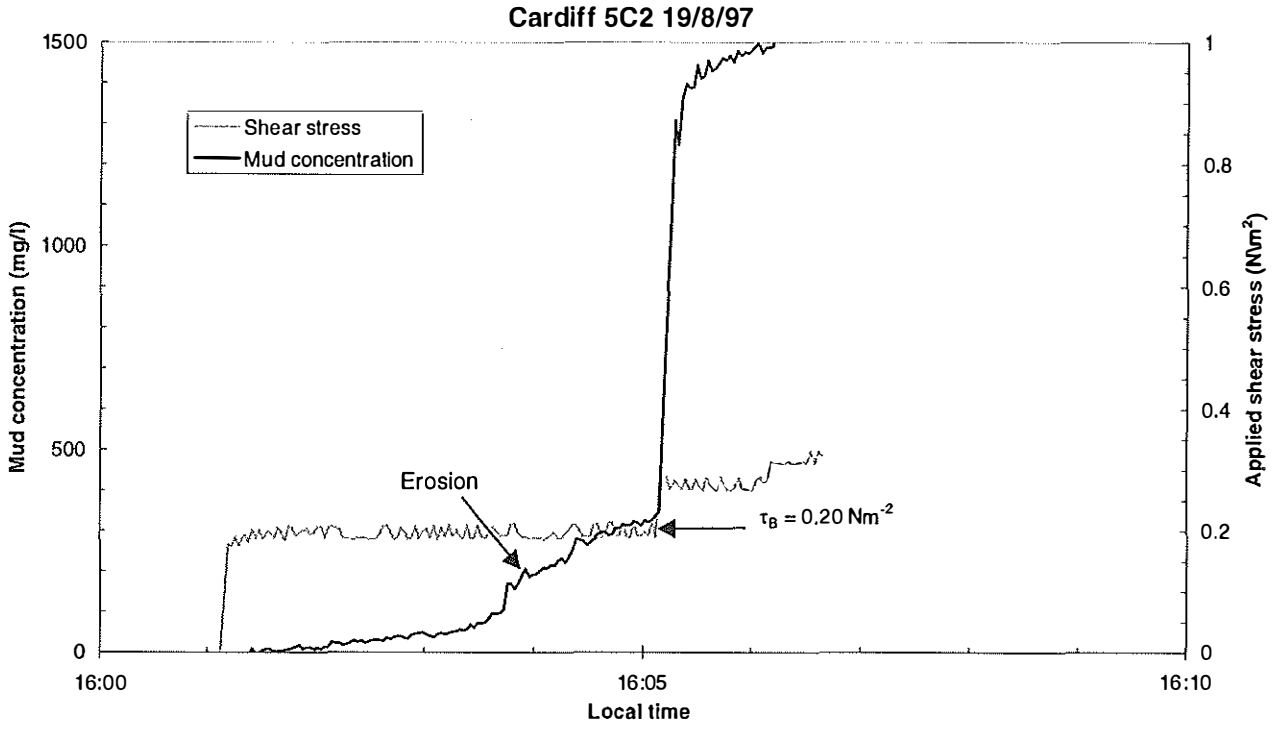



**Site:** **Cardiff seasonal survey August 1997**
Time: 15:58
Date: 19/08/97
Operator: H.J.Mitchener

**Photographs:** Time: 15:53

Film: 1
Number: 6
Number: 7 after erosion






**Site:** **Cardiff seasonal survey August 1997**
Time: 15:58
Date: 19/08/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\caug\caug005.l01

**Site description:**
texture: soft gelatinous surface
colour: pale brown
covering: hydrobia
topography: ± 2mm
biologically activity: hydrobia 20/10cm, worms 5/10cm diam
composition: mud, no sand
other features: dry, sunny, hot, lots of worms & hydrobia on surface. Draining

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 221 | % of dry weight |
| Bulk density: | 1250 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 11.05 | % by weight |
| Median size d50: | 3.5 | microns |
| Sand content: | 0.5 | % by weight |
| Silt content: | 69.9 | % by weight |
| Clay content: | 29.6 | % by weight |
| Mud Temperature: | 29 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.2, 1.2, 0.9, 1.0, 0.9
Average: 1.0

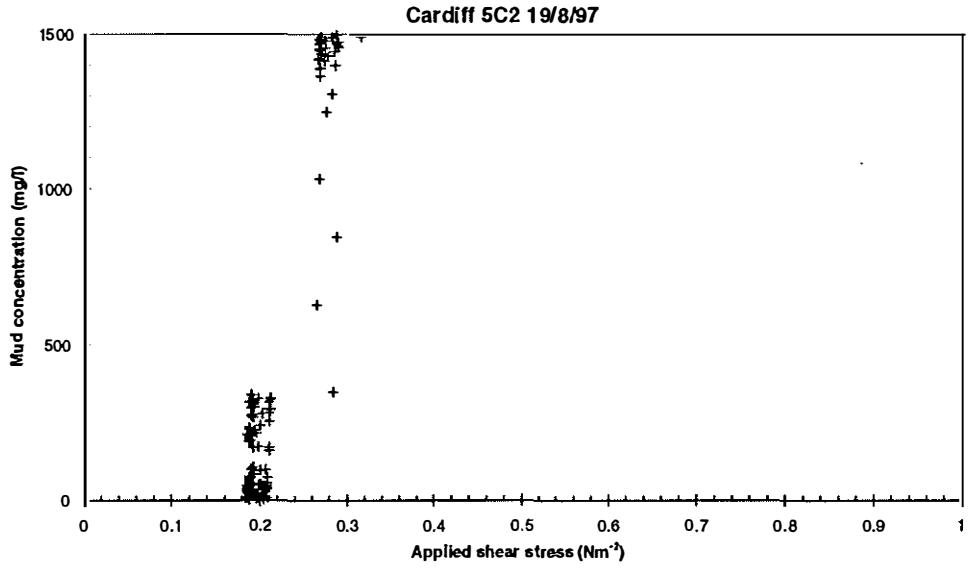
**Eroding Water:** (local collected at HW)
Salinity : 25.63

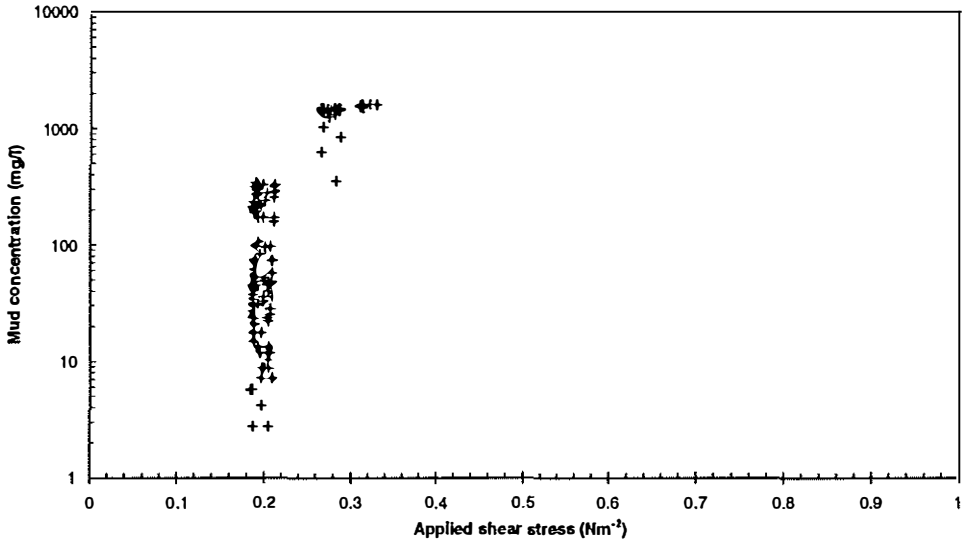
**Photographs:**
Time: 15:53
Film: 1
Number: 6
Number: 7 after erosion

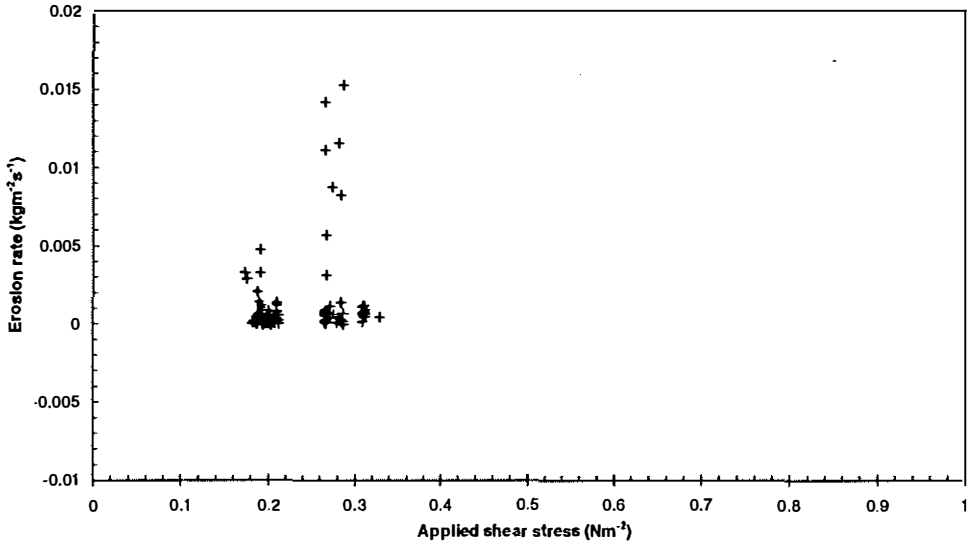
**Comments:**

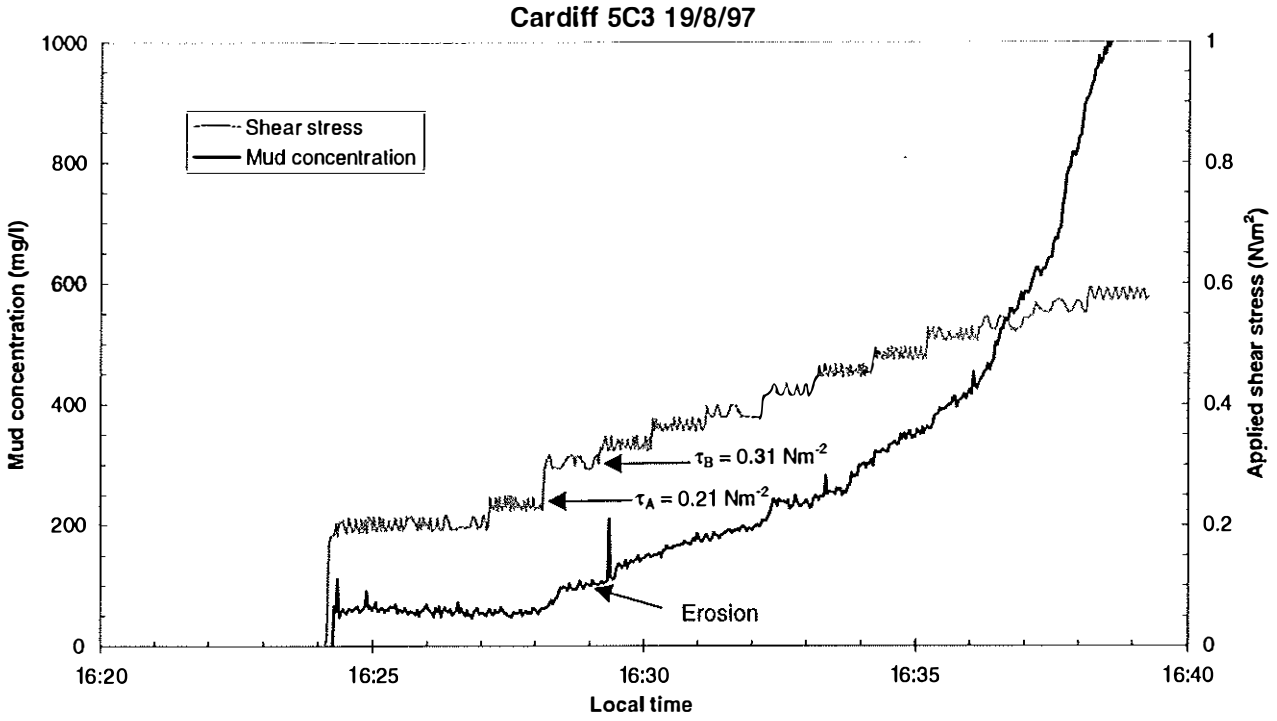
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

| | | |
|---|---|---|
| $\tau_A$ = | 0.00 | Nm$^{-2}$ |
| $\tau_B$ = | 0.20 | Nm$^{-2}$ |
| Average = | 0.10 | Nm$^{-2}$ |


Cardiff 5C2 19/8/97
Mud concentration (mg/l)
1500
1000
500
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.02
0.015
0.01
0.005
0
-0.005
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey August 1997**
Time: 16:19
Date: 19/08/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardifl\caug\caug006.l01

**Site description:**
texture: gelatinous, medium soft
colour: pale brown
covering: hydrobla
topography: +/-2mm
biologically activity: hydrobia 20/10cm, worms 5/10cm diam
composition: mud, no sand
other features: on ridge, drained slightly on filling. Cooler now, some light breeze

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 218 | % of dry weight |
| Bulk density: | 1253 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.60 | % by weight |
| Median size d50: | 2.8 | microns |
| Sand content: | 1.8 | % by weight |
| Silt content: | 55.7 | % by weight |
| Clay content: | 42.5 | % by weight |
| Mud Temperature: | 28 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.0
1.1
0.9
1.1
1.1
Average: 1.0

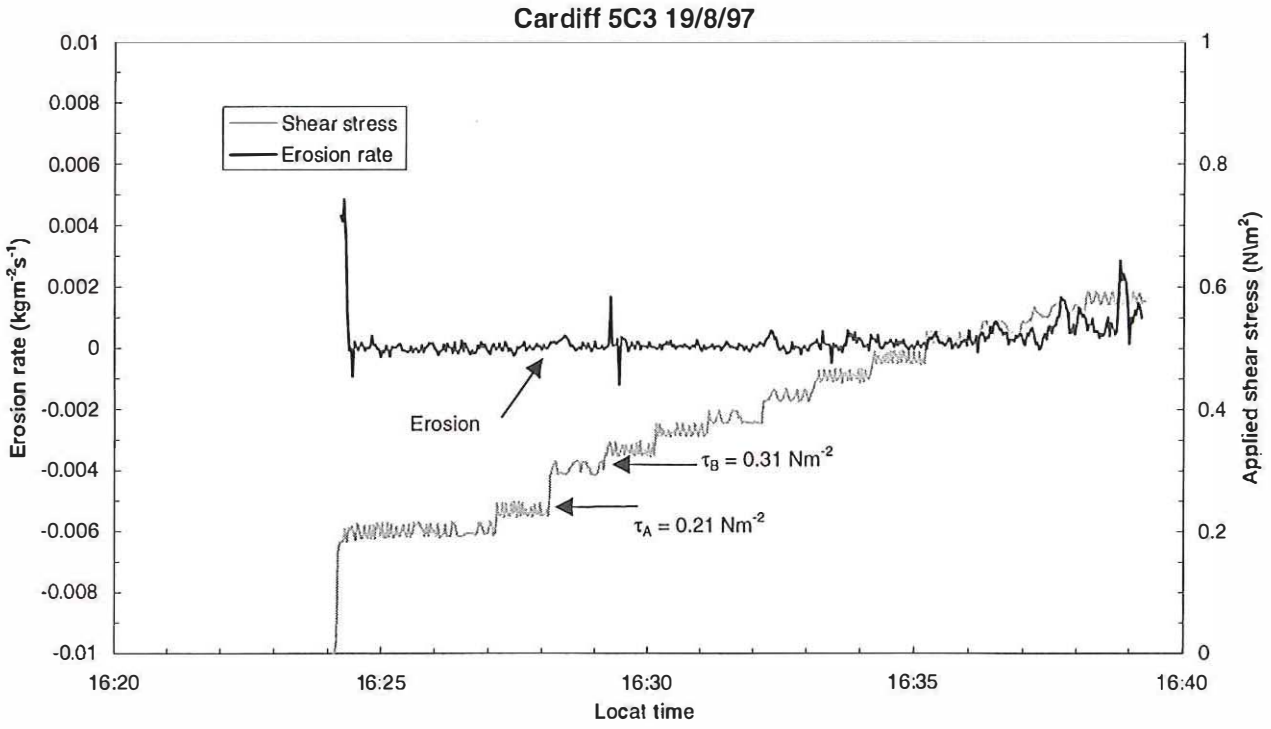
**Eroding Water:** (local collected at HW)
Salinity : 25.63

**Photographs:**
Time: 16:17
Film: 1
Number: 7

**Comments:**

**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

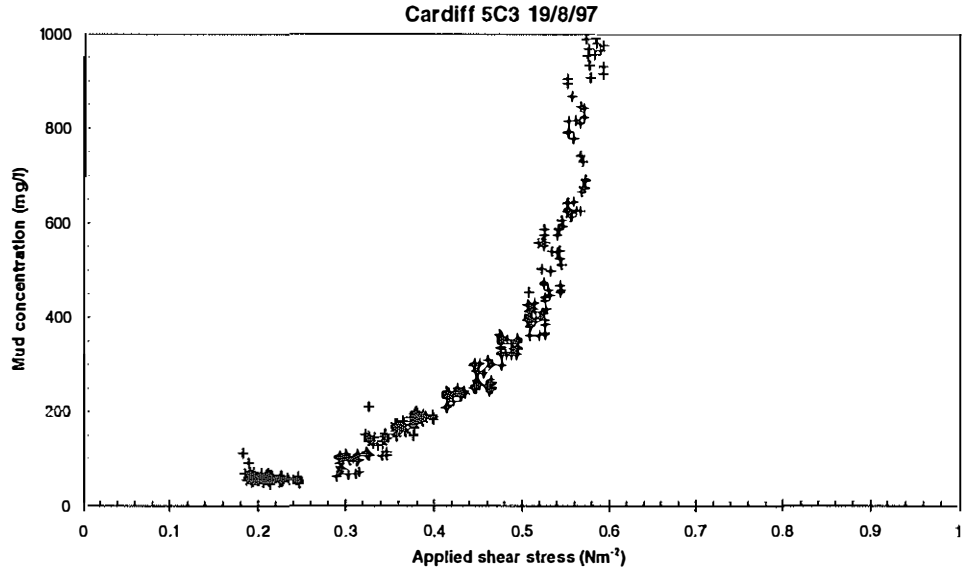
| | | |
|---|---|---|
| $\tau_A$ = | **0.21** | **Nm$^{-2}$** |
| $\tau_B$ = | **0.31** | **Nm$^{-2}$** |
| **Average =** | **0.26** | **Nm$^{-2}$** |

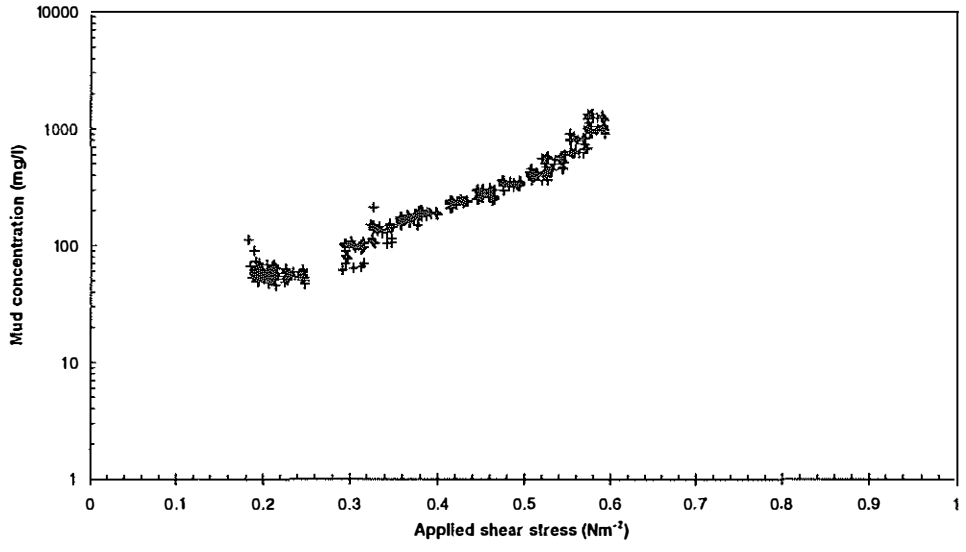


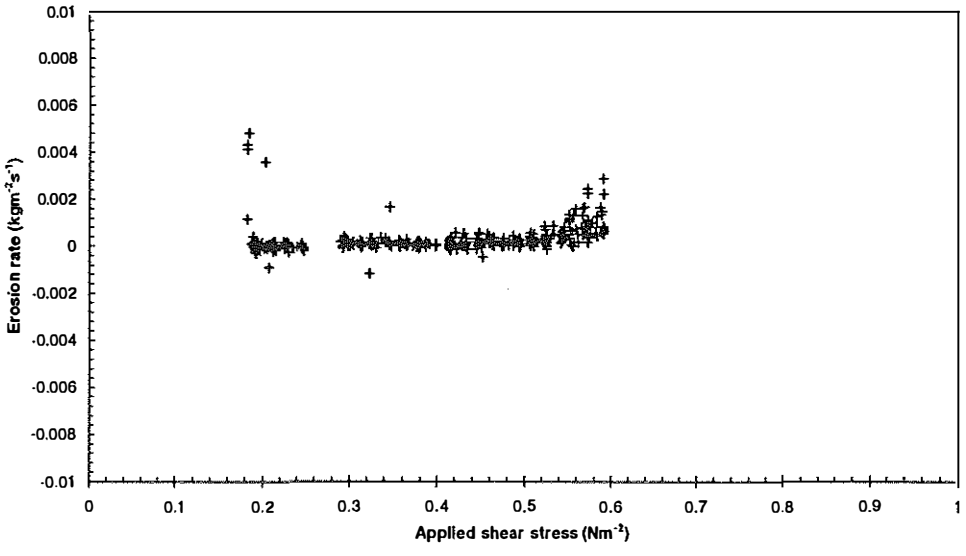

**Site:** **Cardiff seasonal survey August 1997**
Time: 16:19
Date: 19/08/97
Operator: H.J.Mitchener

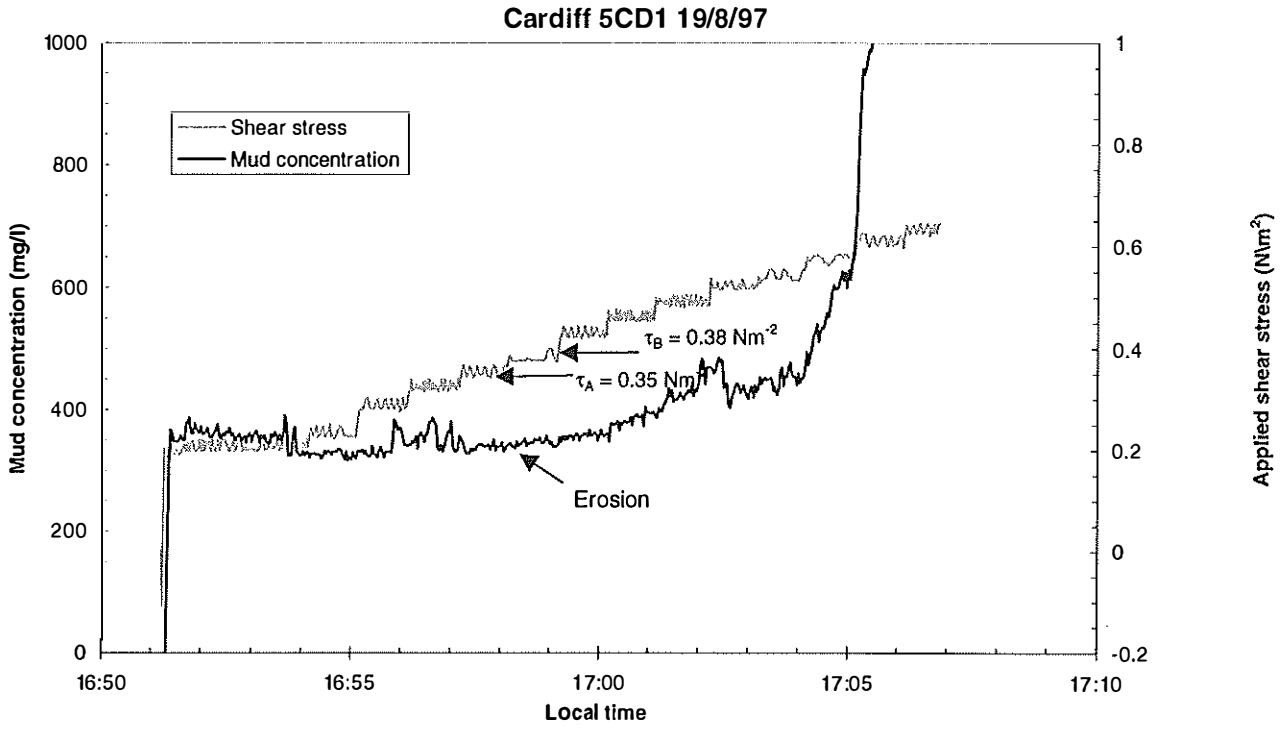
**Photographs:** Time: 16:17

Film: 1
Number: 7


Cardiff 5C3 19/8/97
Mud concentration (mg/l)
Applied shear stress (Nm-2)


Mud concentration (mg/l)
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey August 1997**
Time: 16:49
Date: 19/08/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\caug\caug007.l01

**Site description:**
texture: gelatinous, medium hard
colour: pale brown
covering: scant hydrobia, worm holes
topography: ± 2mm, pitted in parts, worm holes
biologically activity: no hydrobia, rag worms 20-30/10cm diam
composition: mud no sand
other features: hydrobia only in water, not at our site.
Hard surface

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 147 | % of dry weight |
| Bulk density: | 1340 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.50 | % by weight |
| Median size d50: | 2.1 | microns |
| Sand content: | 2.0 | % by weight |
| Silt content: | 48.7 | % by weight |
| Clay content: | 49.3 | % by weight |
| Mud Temperature: | 26 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.7
1.4
1.3
1.6
1.2
Average: 1.4

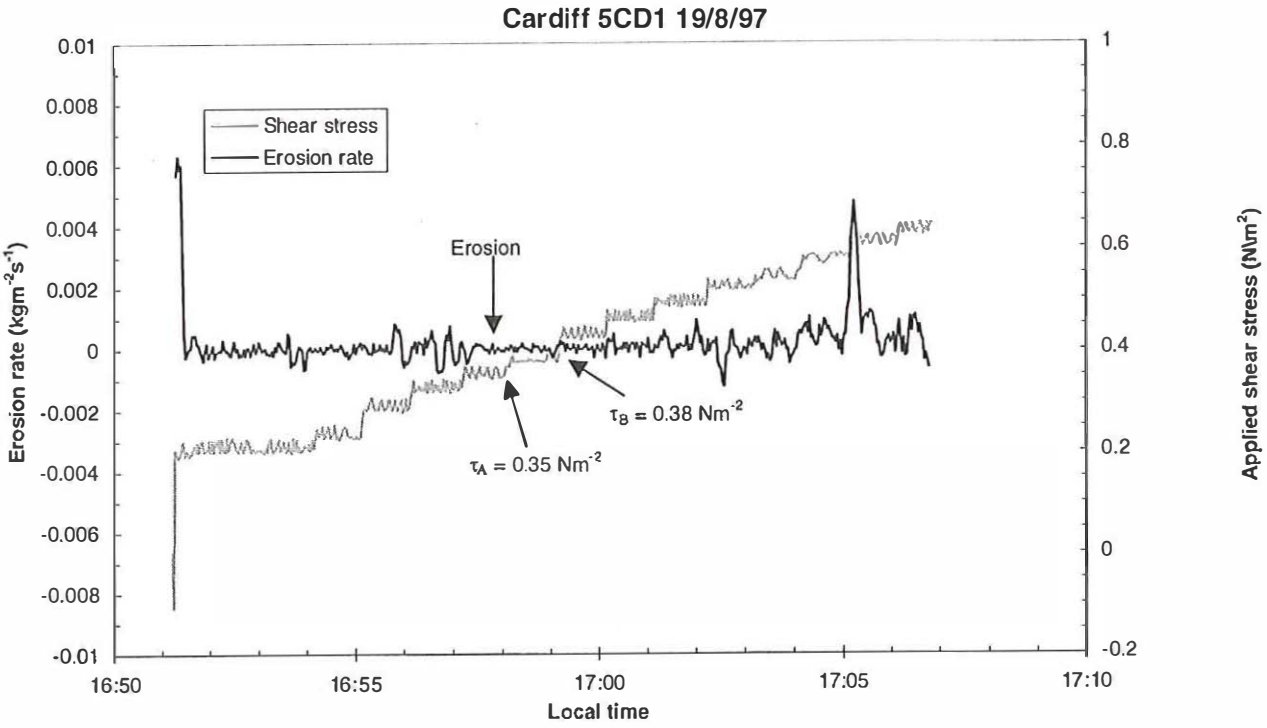
**Eroding Water:** (local collected at HW)
Salinity : 25.63

**Photographs:** Film: 1
Time: 16:46 Number: 9

**Comments:**

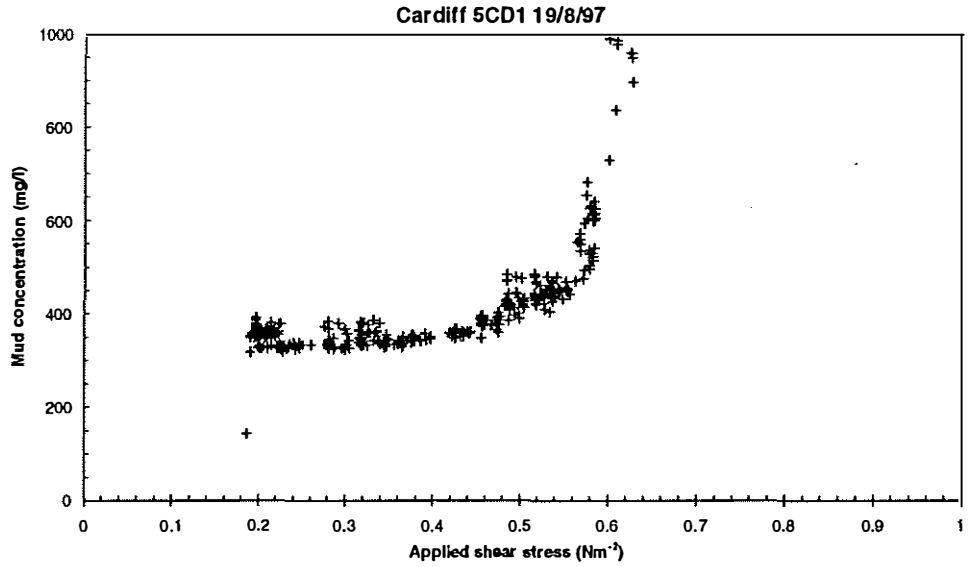
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

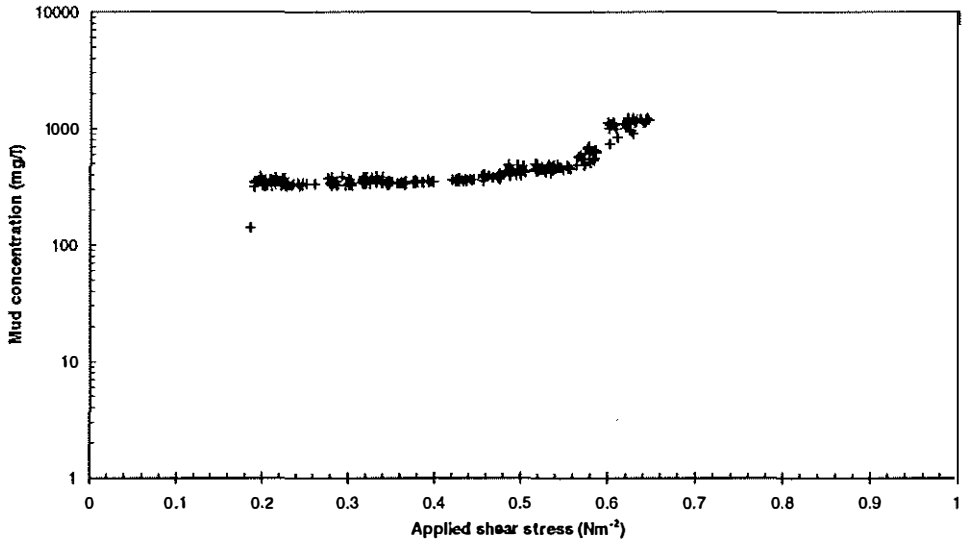
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.35** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.38** | **Nm$^{-2}$** |
| **Average =** | **0.37** | **Nm$^{-2}$** |

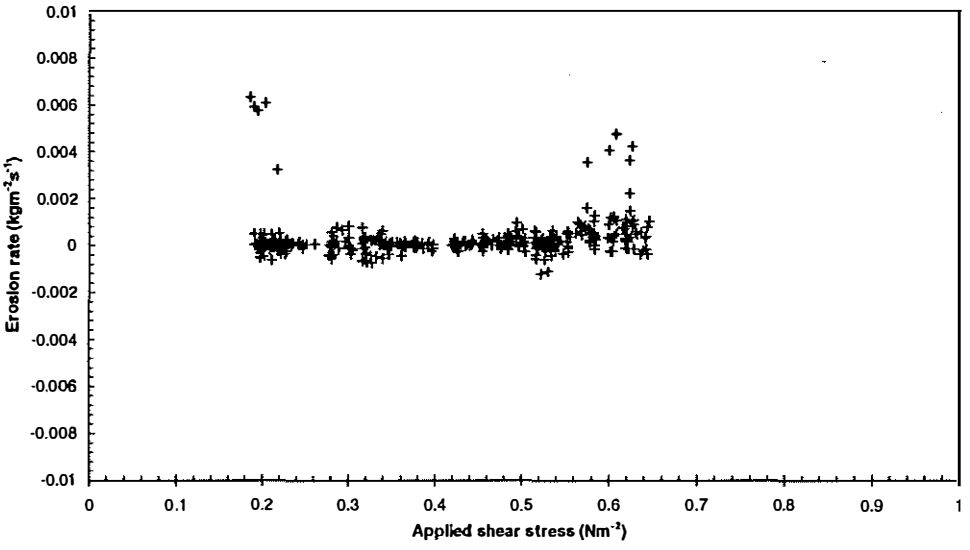


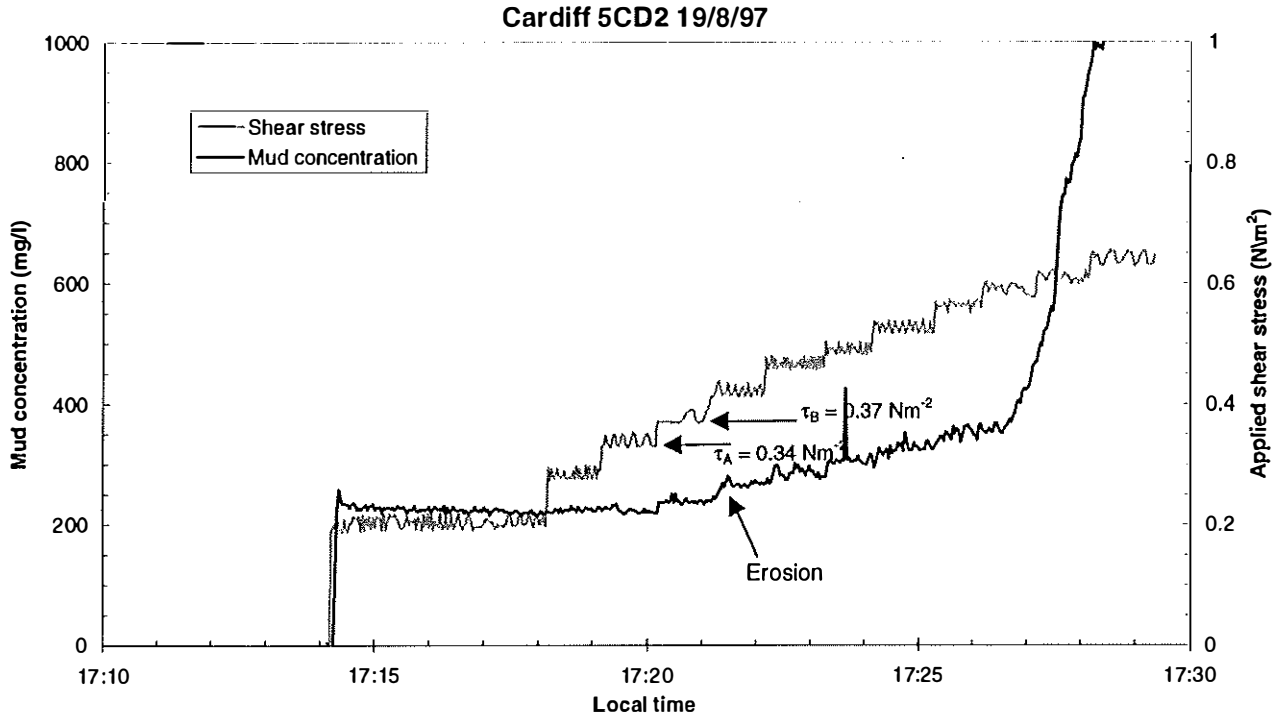

**Site:** **Cardiff seasonal survey August 1997**
Time: 16:49
Date: 19/08/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 16:46 Number: 9


Cardiff 5CD1 19/8/97
Mud concentration (mg/l)
1000
600
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey August 1997**
Time: 17:12
Date: 19/08/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\caug\caug008.l01

**Site description:**
texture: medium hard, gelatinous
colour: pale brown
covering: worms, v scant hydrobia - dry surface
topography: ± 1mm
biologically activity: worms ~20-30/10cm diam
composition: mud, no sand
other features: firm gelatinous mud - on dry patch ∴ no hydrobia. Cooler but still hot

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 145 | % of dry weight |
| Bulk density: | 1344 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.31 | % by weight |
| Median size d50: | 2.2 | microns |
| Sand content: | 1.0 | % by weight |
| Silt content: | 50.9 | % by weight |
| Clay content: | 48.1 | % by weight |
| Mud Temperature: | 26.5 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.2
1.8
1.9
1.6
1.9
Average: 1.7

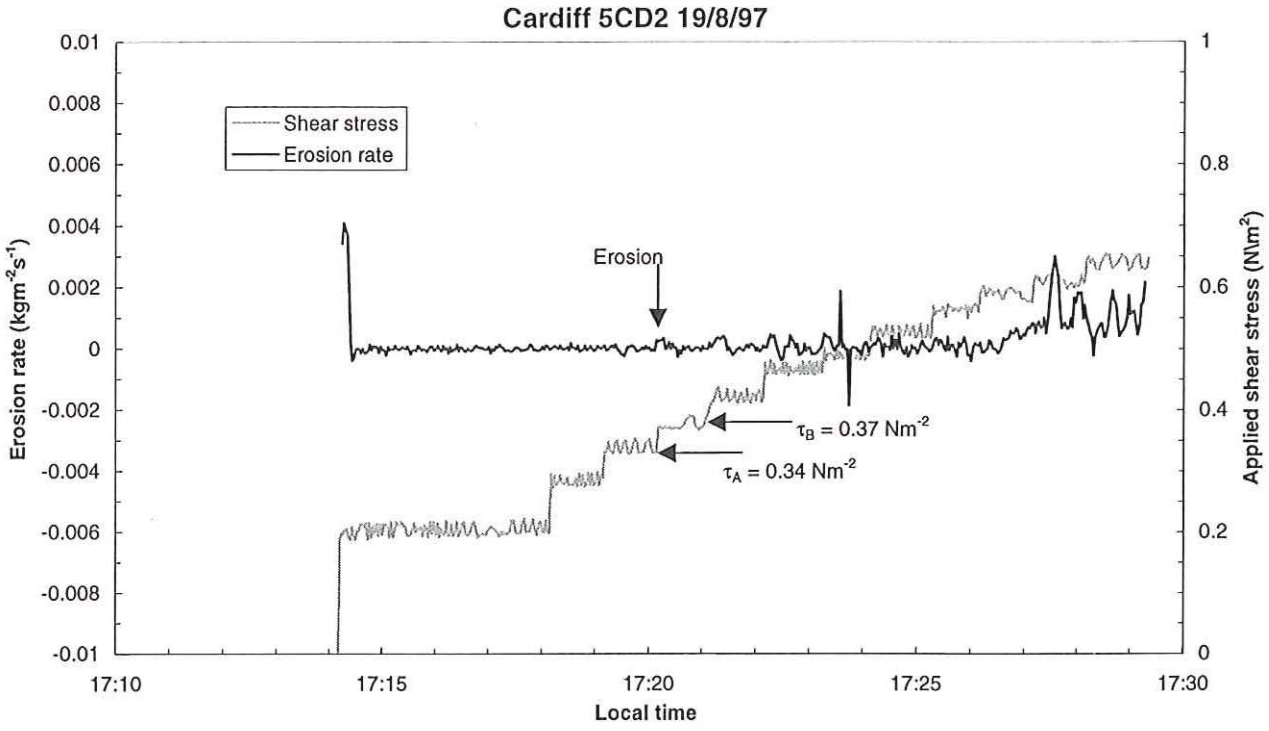
**Eroding Water:** (local collected at HW)
Salinity : 25.63

**Photographs:**
Time: 17:10
Film: 1
Number: 10

**Comments:**

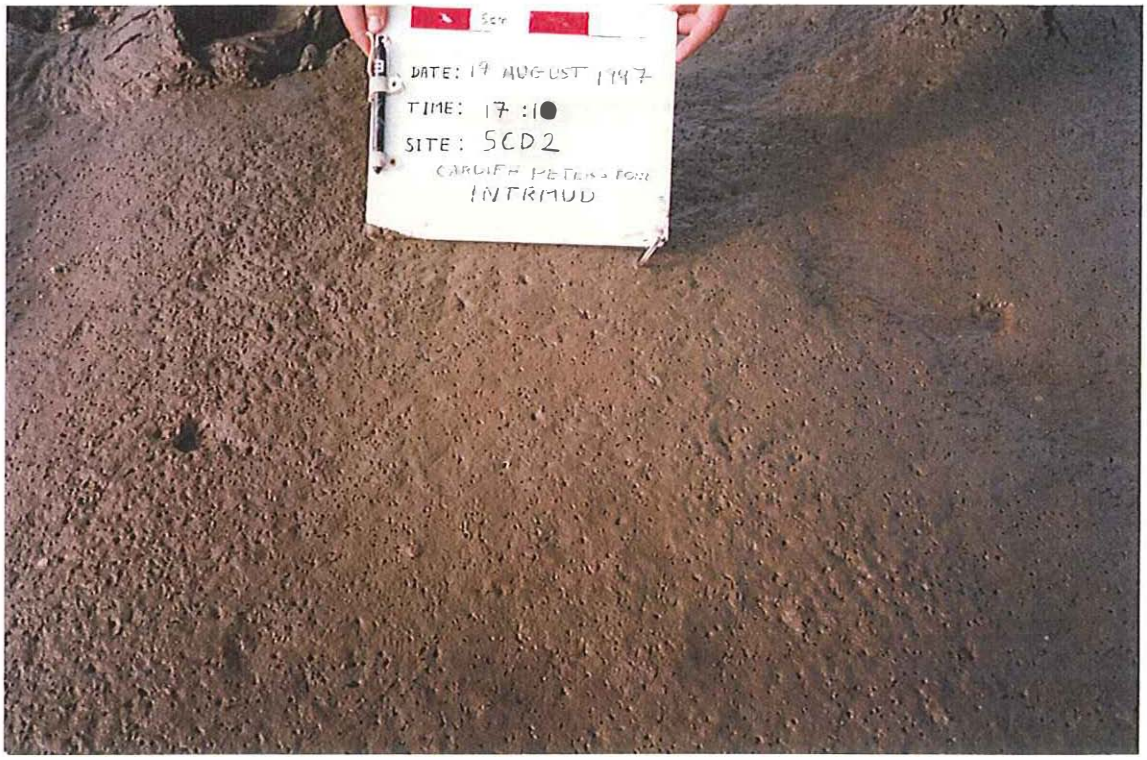
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

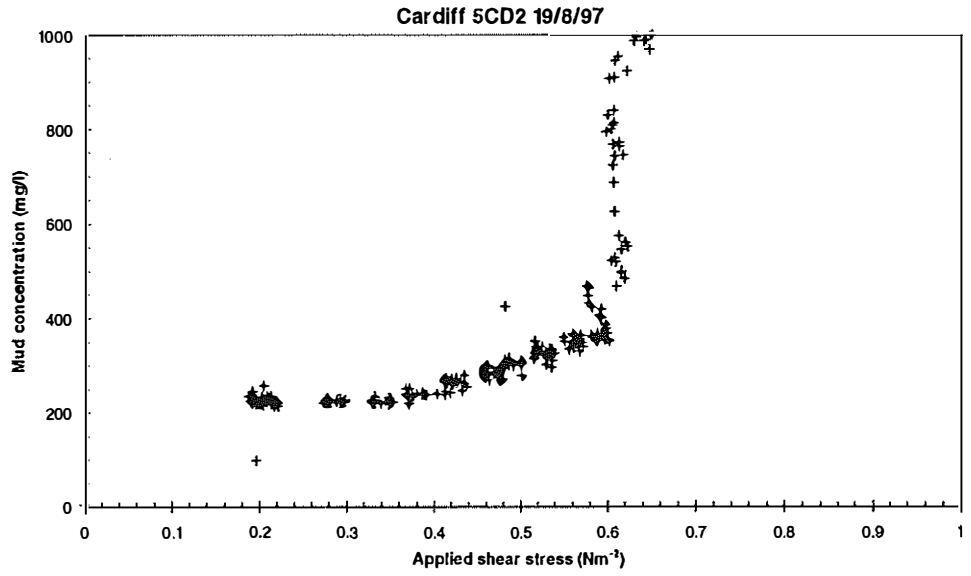
| | | |
|---|---|---|
| $\tau_A$ = | 0.34 | Nm$^{-2}$ |
| $\tau_B$ = | 0.37 | Nm$^{-2}$ |
| **Average =** | 0.36 | Nm$^{-2}$ |

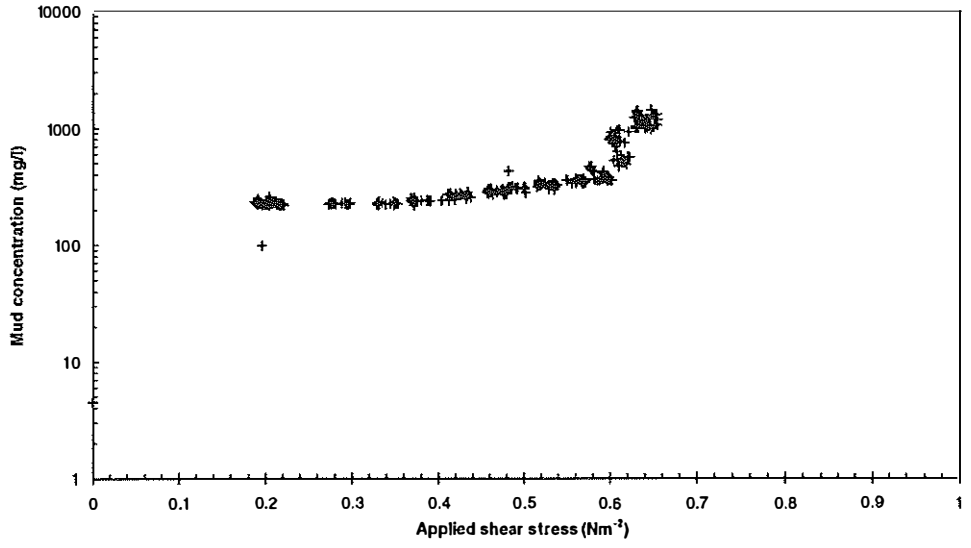


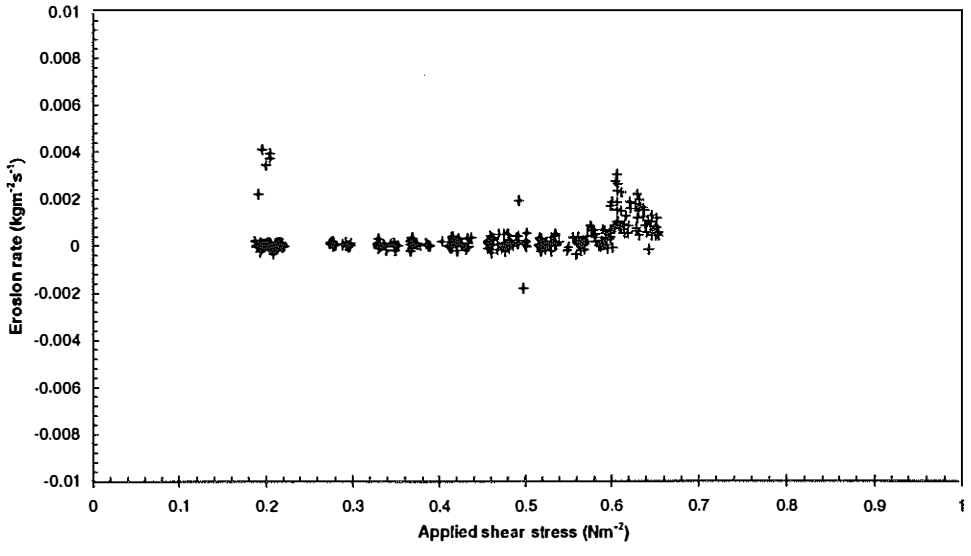

**Site:** **Cardiff seasonal survey August 1997**
Time: 17:12
Date: 19/08/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 17:10 Number: 10



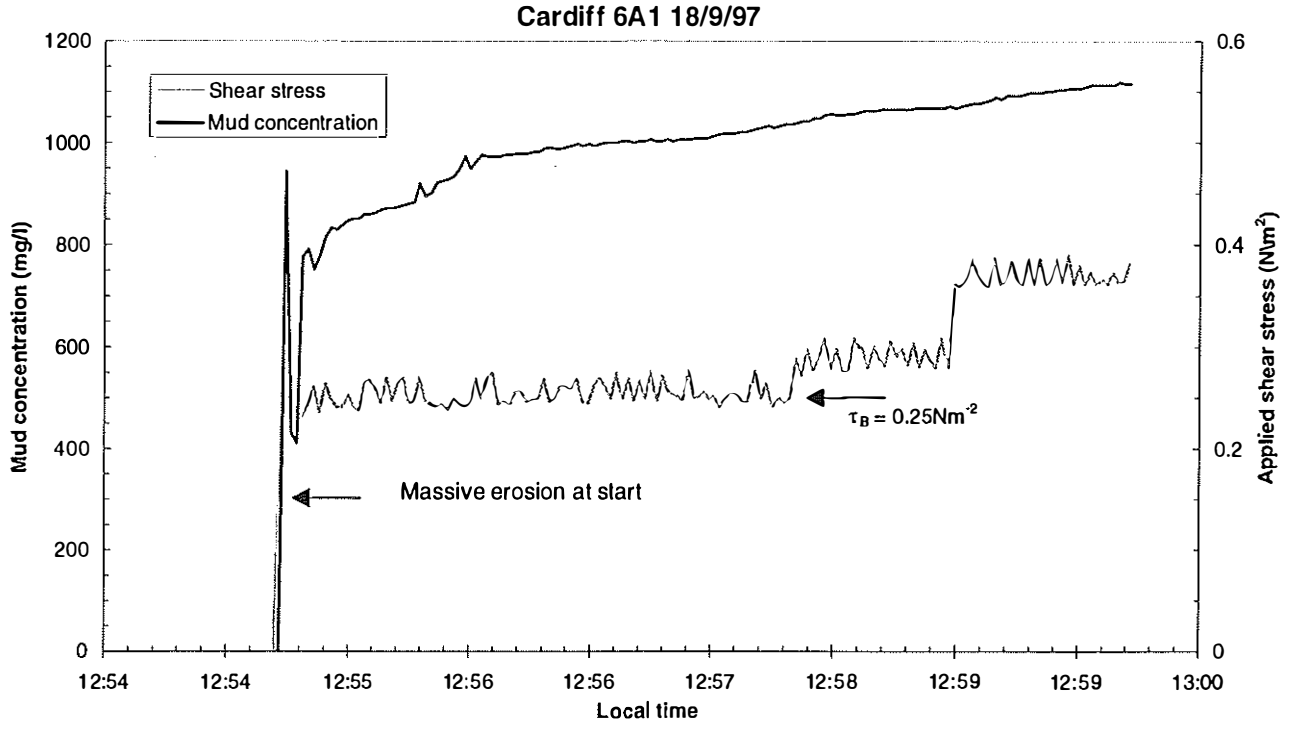

Cardiff 5CD2 19/8/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)

# SedErode Data Plots

## Cardiff September 1997




**Site:** **Cardiff seasonal survey September 1997**
Time: 12:54
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\csep001.l01

**Site description:**
texture: Very soft
colour: Pale brown
covering: Water & Hydrobia
topography: +/- 1mm (flat as fluid deposit)
biologically activity: Hydrobia ~25-30/10cm diameter
composition: Mud / Hydrobia
other features: Very soft surface
1.5cm fluid mud from last spring tide
Very sunny

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 348 | % of dry weight |
| Bulk density: | 1174 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 10.89 | % by weight |
| Median size d50: | 1.54 | microns |
| Sand content: | 2.0 | % by weight |
| Silt content: | 43.4 | % by weight |
| Clay content: | 54.6 | % by weight |
| Mud Temperature: | 22 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.7
0.6
0.4
0.8
**0.7**
Average: 0.6

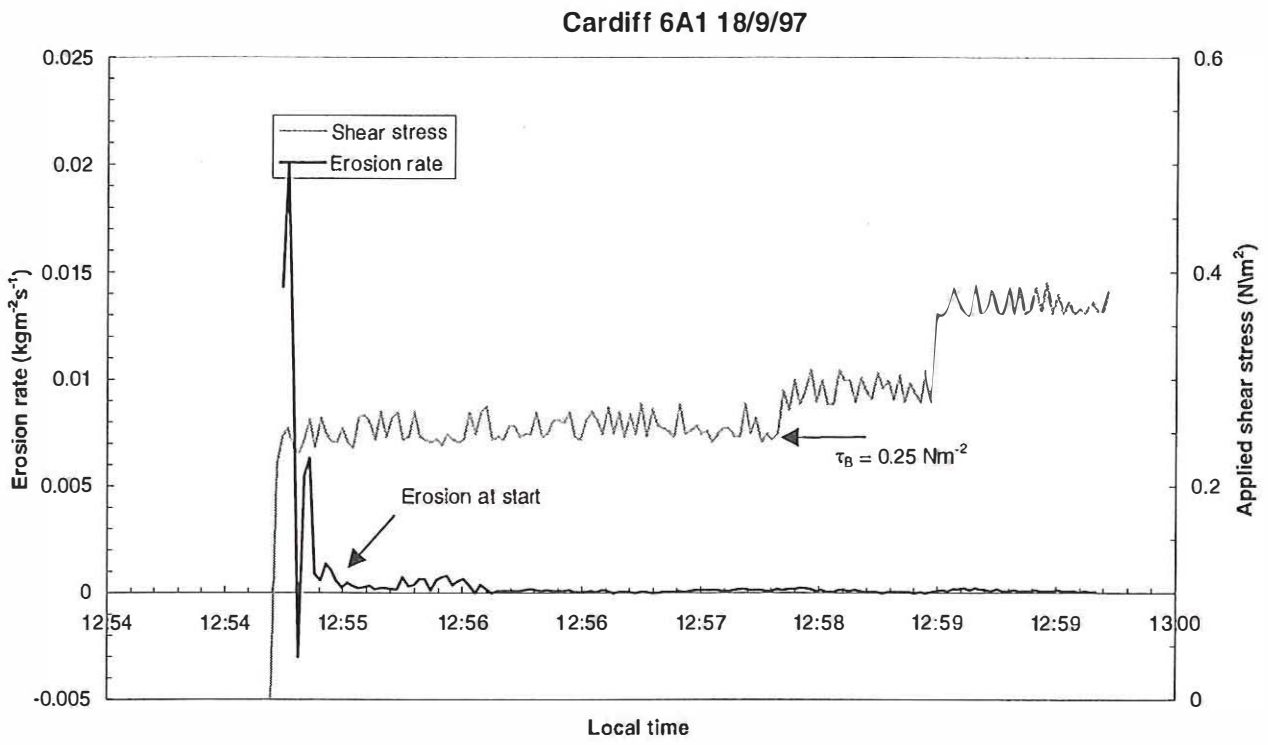
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 12:10 Number: 2

**Comments:** Neph. 150 model used

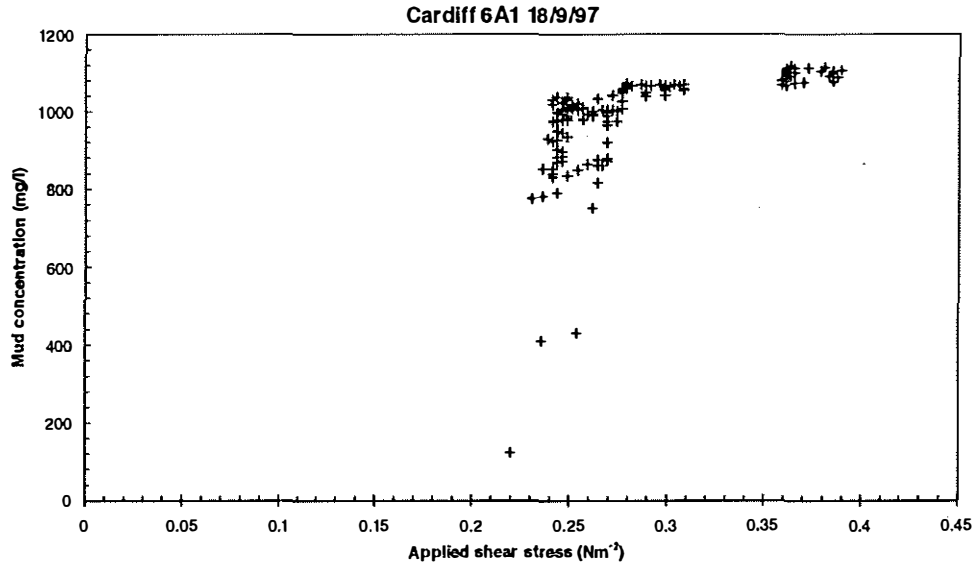
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

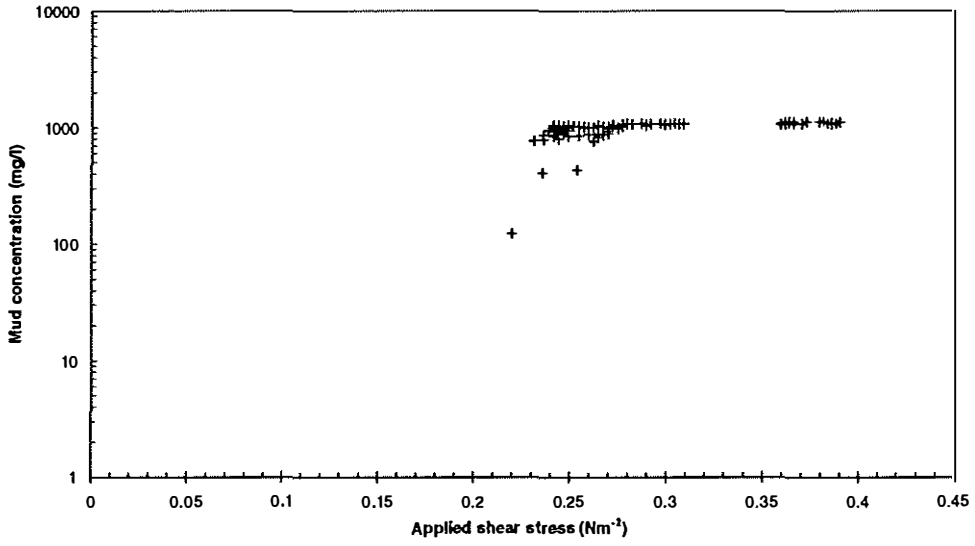
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.00** | **$Nm^{-2}$** |
| **$\tau_B$ =** | **0.25** | **$Nm^{-2}$** |
| **Average =** | **0.13** | **$Nm^{-2}$** |

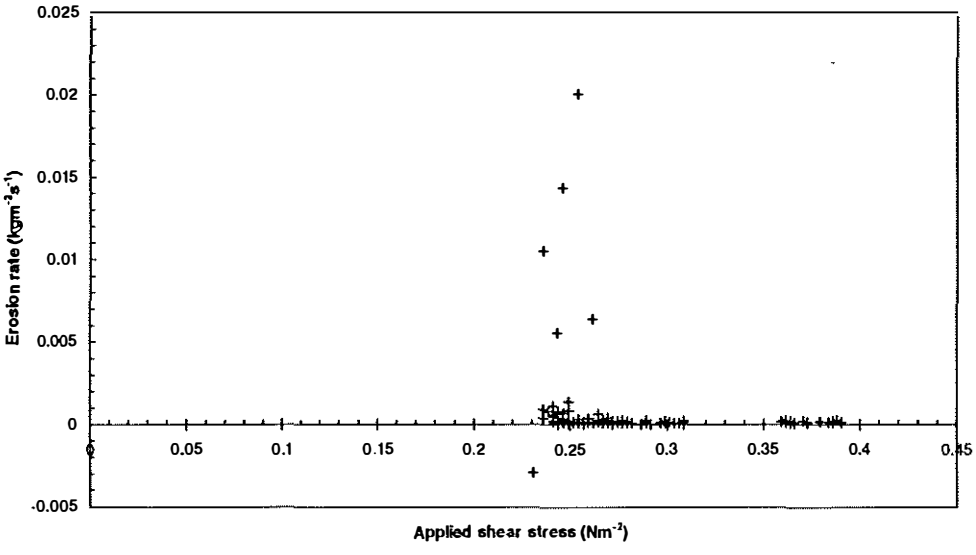


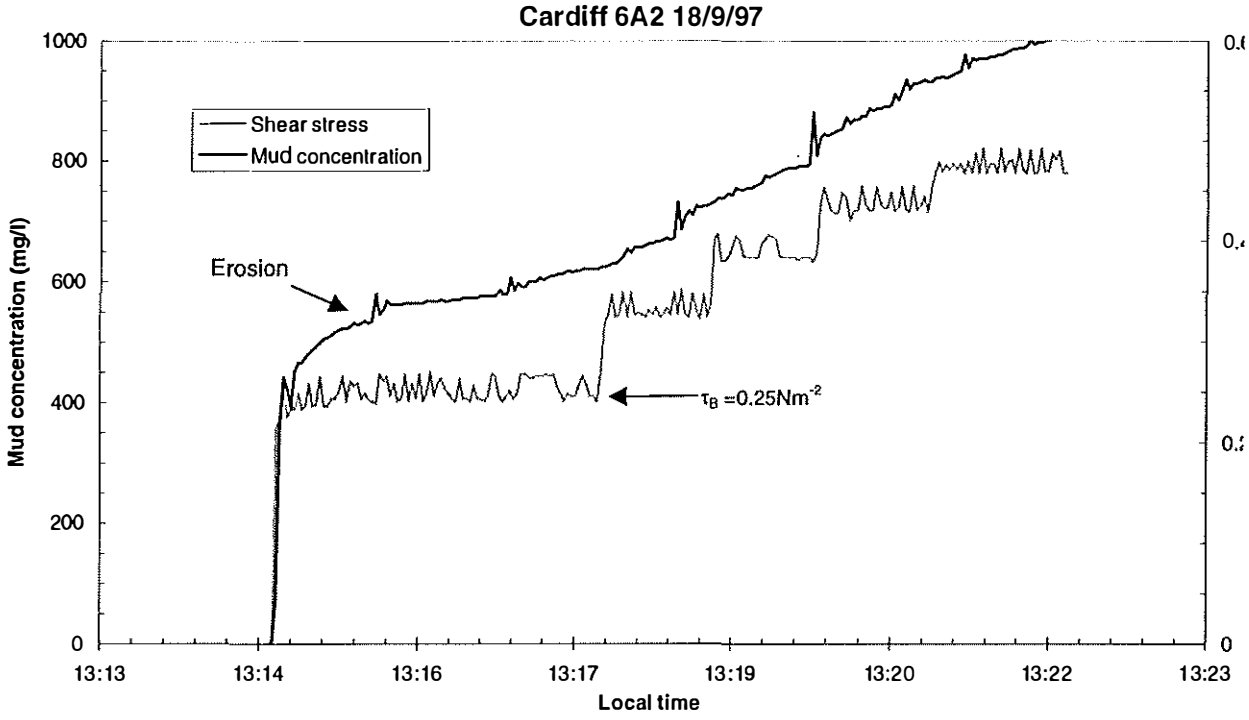

**Site:** **Cardiff seasonal survey September 1997**
Time: 12:54
Date: 18/09/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 12:10 Number: 2


Cardiff 6A1 18/9/97
Mud concentration (mg/l)
1200
1000
800
600
400
200
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.025
0.02
0.015
0.01
0.005
0
-0.005
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey September 1997**
Time: 13:14
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data lo
Path: ..\sediments\helen\intrmud\cardiff\

**Site description:**
texture: Very soft
colour: Pale brown
covering: Water & Hydrobia
topography: +/- 1mm (flat as fluid deposit)
biologically activity: Hydrobia ~25-30/10cm diameter
composition: Mud / Hydrobia
other features: Very soft surface
1.5cm fluid mud from last spring tide
Very sunny

**Surface sample:** (from top 5mm) -

| | |
|---|---|
| Water content: | 348 |
| Bulk density: | 1174 |
| Carbon (loss on ignition): | 10.60 |
| Median size d50: | 1.51 |
| Sand content: | 1.3 |
| Silt content: | 43.5 |
| Clay content: | 55.2 |
| Mud Temperature: | 23 |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.9, 0.7, 0.9, 1.0, 0.9
Average: 0.9

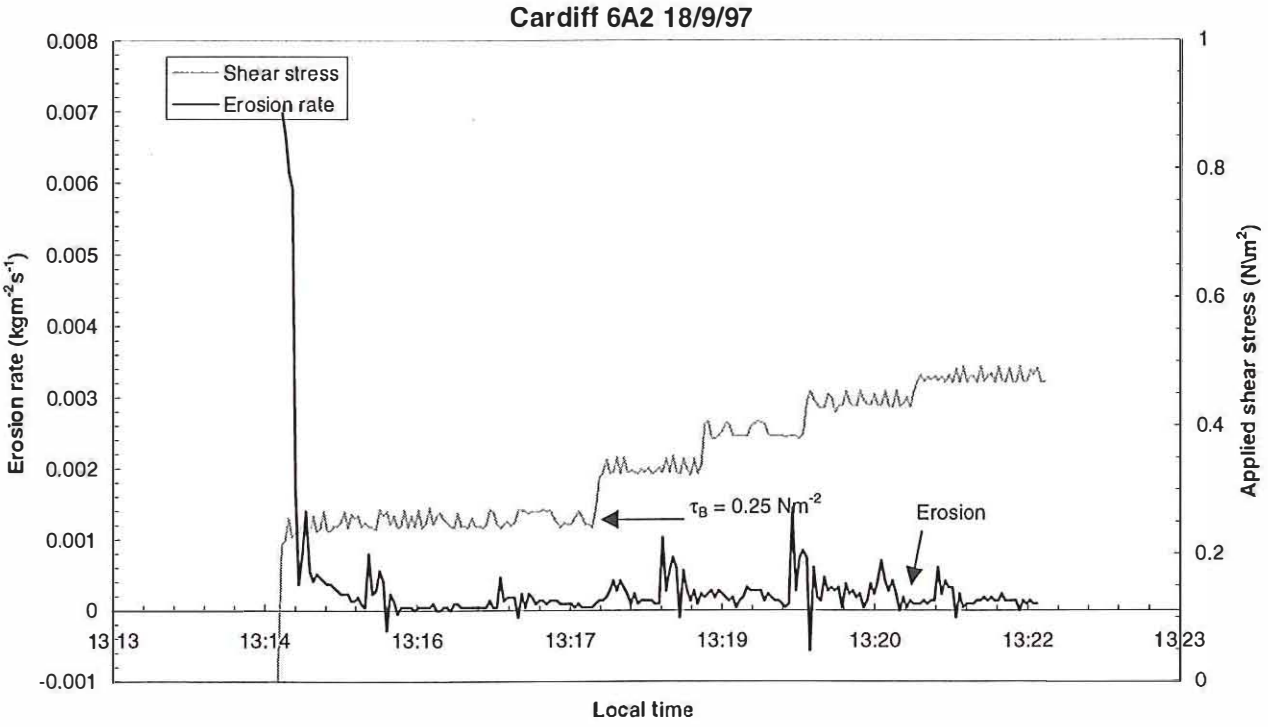
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 13:09 Number: 3

**Comments:** Approx. 1m from 6A1

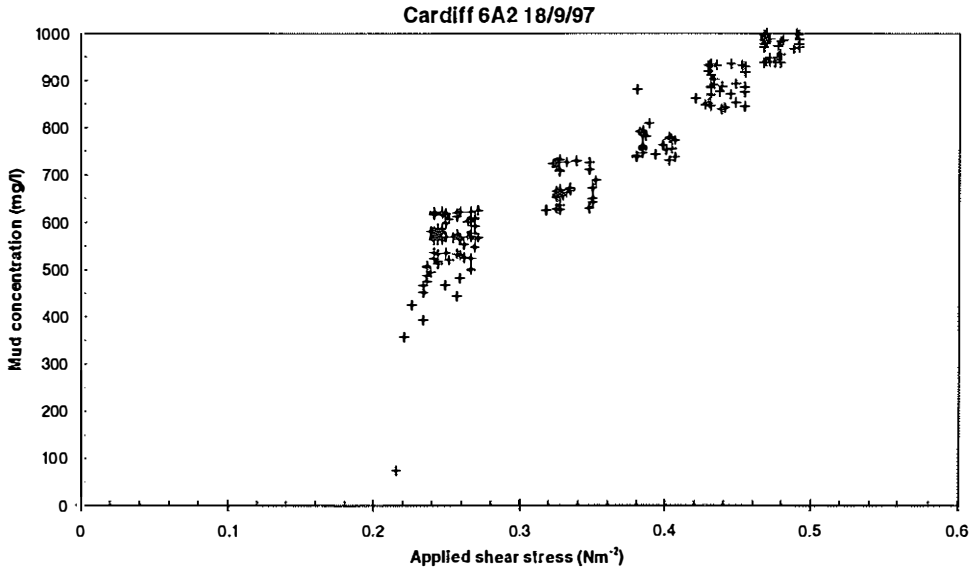
**Critical erosion shear stress between $\tau_A$ &**

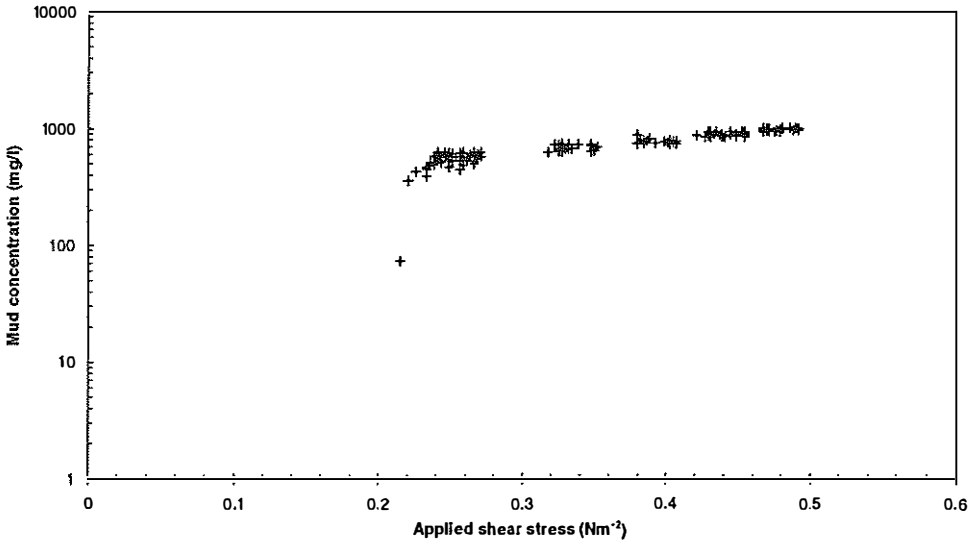
| | | |
|---|---|---|
| $\tau_A$ = | 0.00 | Nm$^{-2}$ |
| $\tau_B$ = | 0.25 | Nm$^{-2}$ |
| Average = | 0.13 | Nm$^{-2}$ |

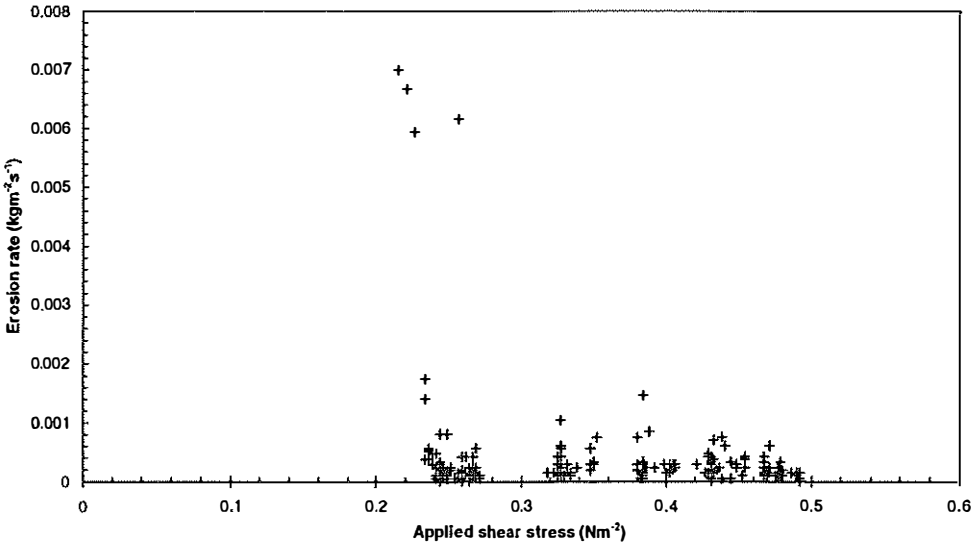


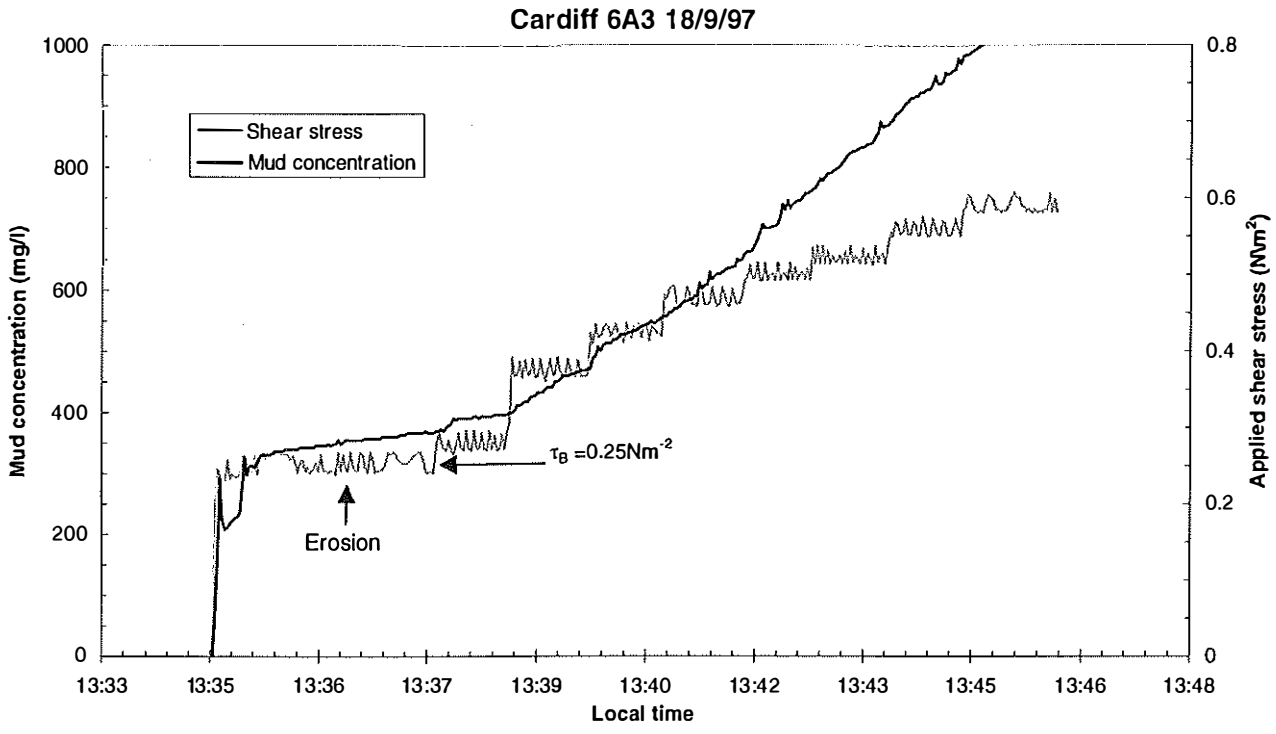

**Site:** **Cardiff seasonal survey September 1997**
Time: 13:14
Date: 18/09/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 13:09 Number: 3


Cardiff 6A2 18/9/97
Mud concentration (mg/l)
Applied shear stress (Nm-2)


Mud concentration (mg/l)
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey September** 1997
Time: 13:35
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\csep003.l01

**Site description:**
texture: Firmer than 6A2
colour: Pale brown
covering: Water & Hydrobia
topography: +/- 1mm (flat as fluid deposit)
biologically activity: Hydrobia ~25-30/10cm Diameter
composition: Mud / Hydrobia
other features: Very soft surface
1.5cm fluid mud from last spring tide
Very sunny

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 303 | % of dry weight |
| Bulk density: | 1194 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 11.67 | % by weight |
| Median size d50: | 1.92 | microns |
| Sand content: | 1.9 | % by weight |
| Silt content: | 47.3 | % by weight |
| Clay content: | 50.8 | % by weight |
| Mud Temperature: | 24 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.1
1.2
1.1
1.1
1.1
Average: 1.1

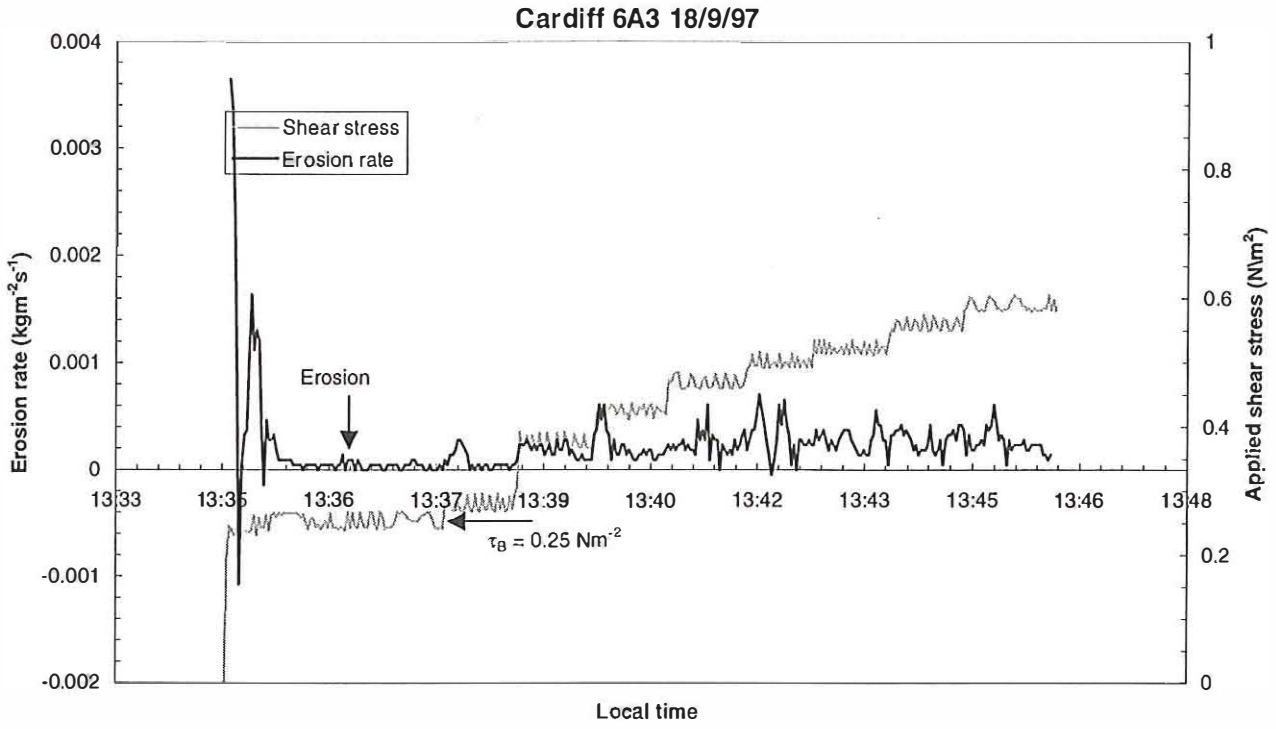
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 13:27 Number: 4

**Comments:** Approx. 2mm from 6A1

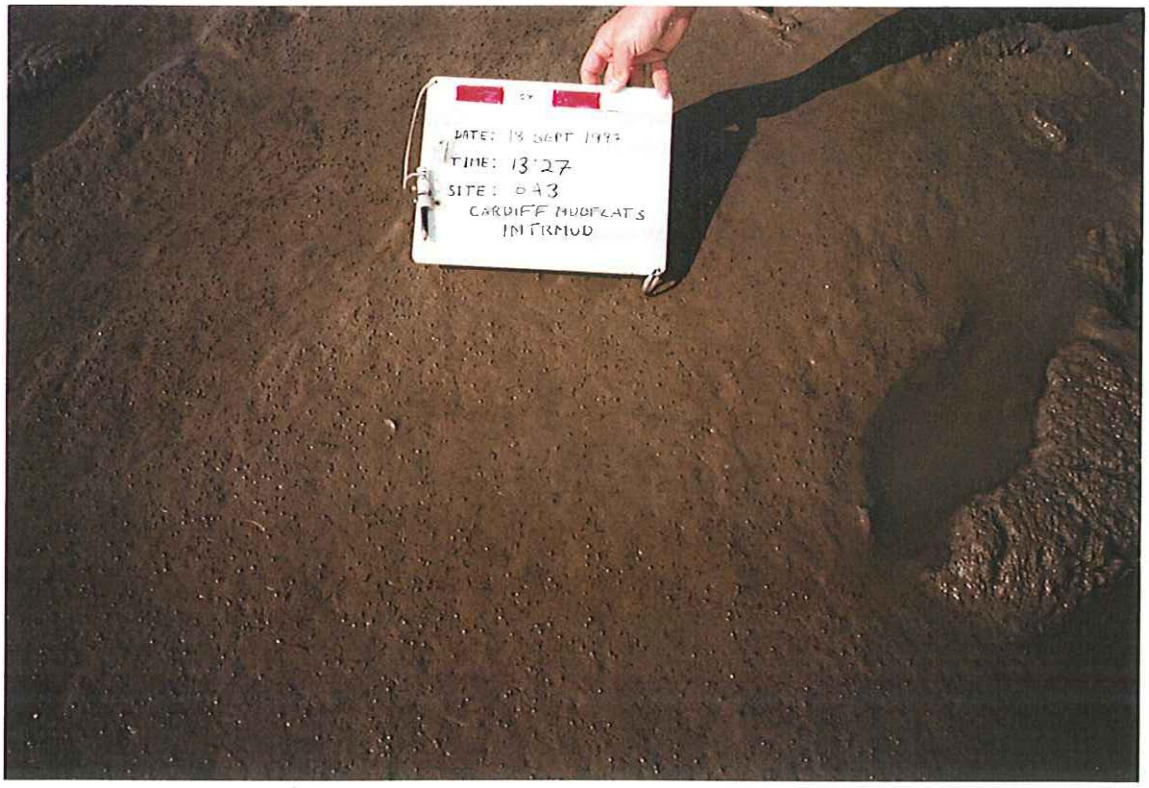
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

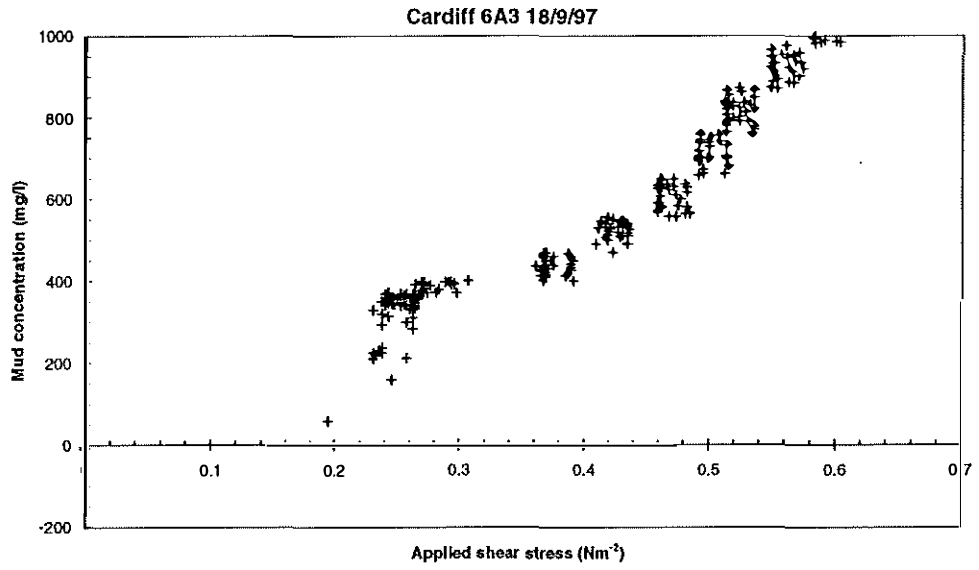
| | | |
|---|---|---|
| $\tau_A$ = | 0.00 | Nm$^{-2}$ |
| $\tau_B$ = | 0.25 | Nm$^{-2}$ |
| Average = | 0.13 | Nm$^{-2}$ |

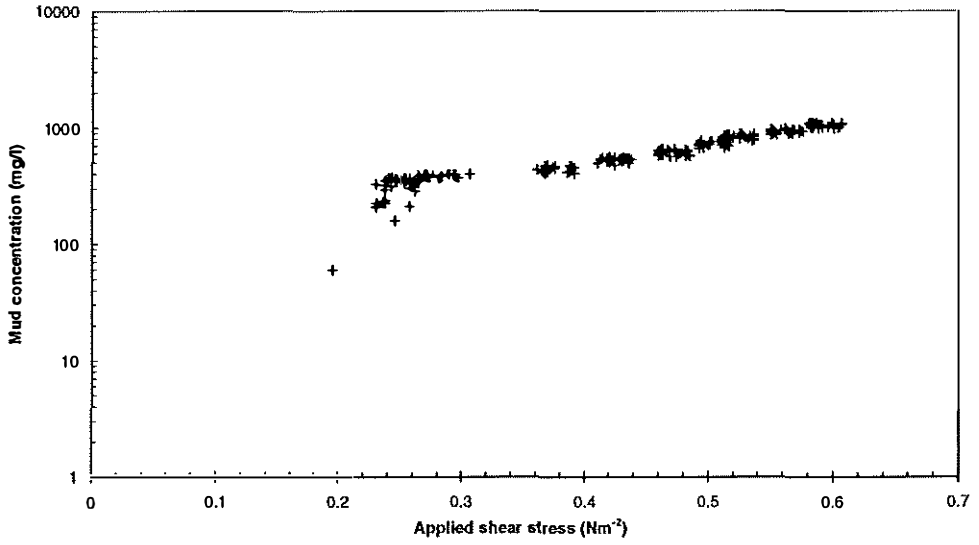


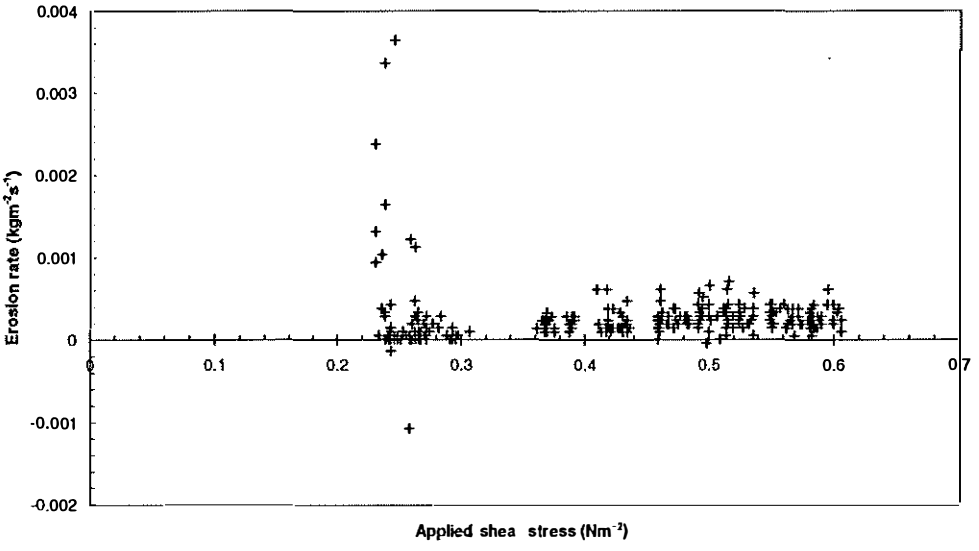

**Site:** **Cardiff seasonal survey September 1997**
Time: 13:35
Date: 18/09/97
Operator: H.J.Mitchener

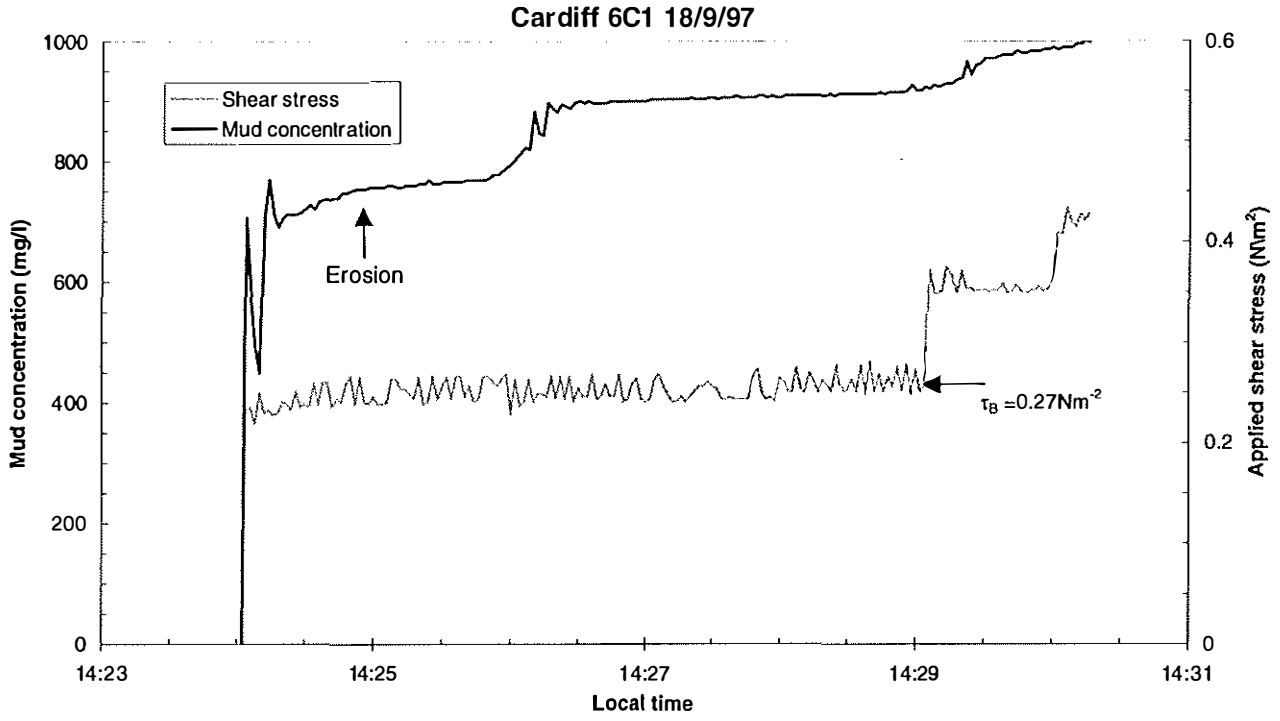
**Photographs:** Film: 1
Time: 13:27 Number: 4




Cardiff 6A3 18/9/97
Mud concentration (mg/l)
1000
800
600
400
200
0
-200
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.004
0.003
0.002
0.001
0
-0.001
-0.002
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Applied shea stress (Nm-2)




**Site:** **Cardiff seasonal survey September** 1997
Time: 14:24
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\heten\intrmud\cardiff\csep004.l01

**Site description:**
texture: Soft new deposit
colour: Pale brown
covering: Hydrobia, surface water in patches
topography: +/- 1mm, hydrobia snails
biologically activity: Hydrobia ~15-20/10cm, 1 worm/10cm diameter
composition: Mud, no sand
other features: Underconsolidated

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 256 | % of dry weight |
| Bulk density: | 1223 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 11.43 | % by weight |
| Median size d50: | 2.12 | microns |
| Sand content: | 0.3 | % by weight |
| Silt content: | 50.8 | % by weight |
| Clay content: | 48.9 | % by weight |
| Mud Temperature: | 23 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.0
1.0
0.9
0.7
1.0
Average: 0.9

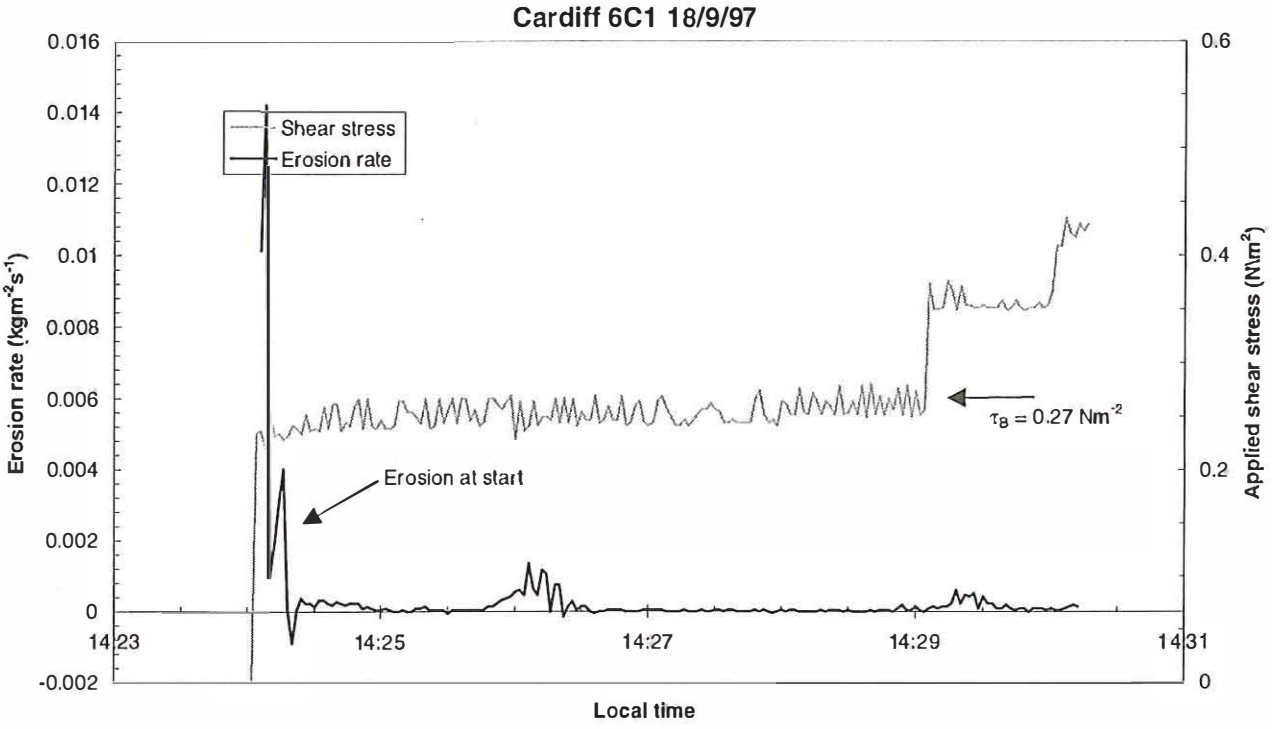
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 14:15 Number: 5

**Comments:** Not as soft as site A

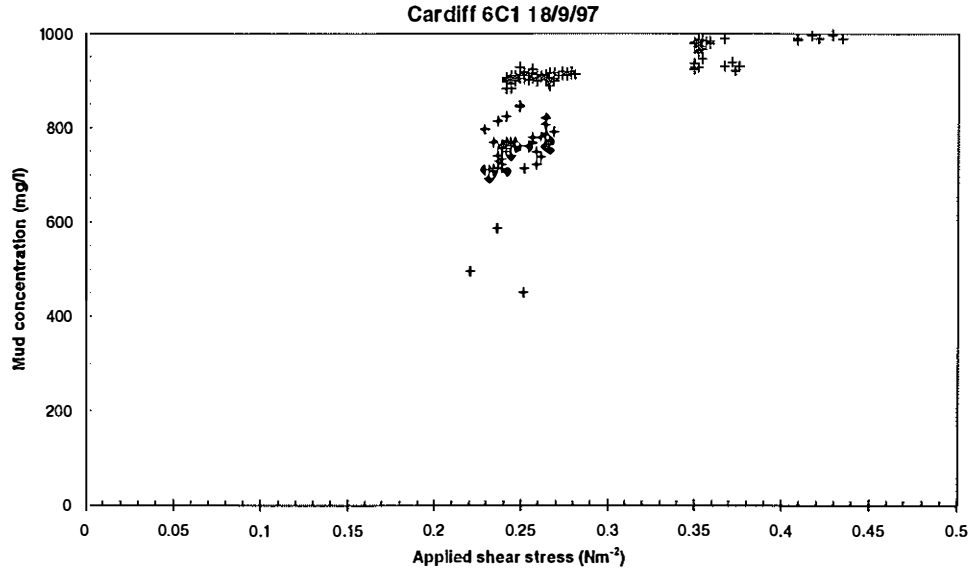
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

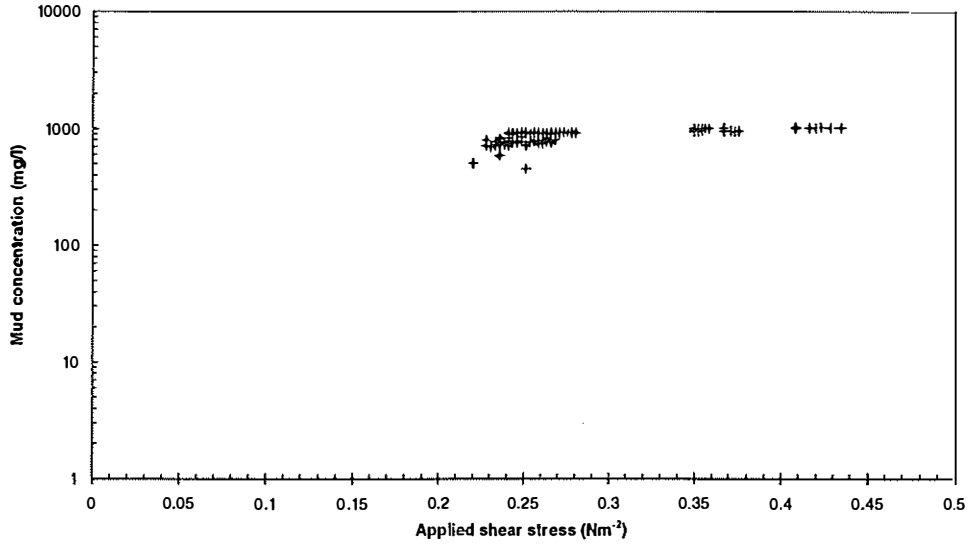
| | | |
|---|---|---|
| $\tau_A$ = | 0.00 | Nm$^{-2}$ |
| $\tau_B$ = | 0.27 | Nm$^{-2}$ |
| Average = | 0.14 | Nm$^{-2}$ |

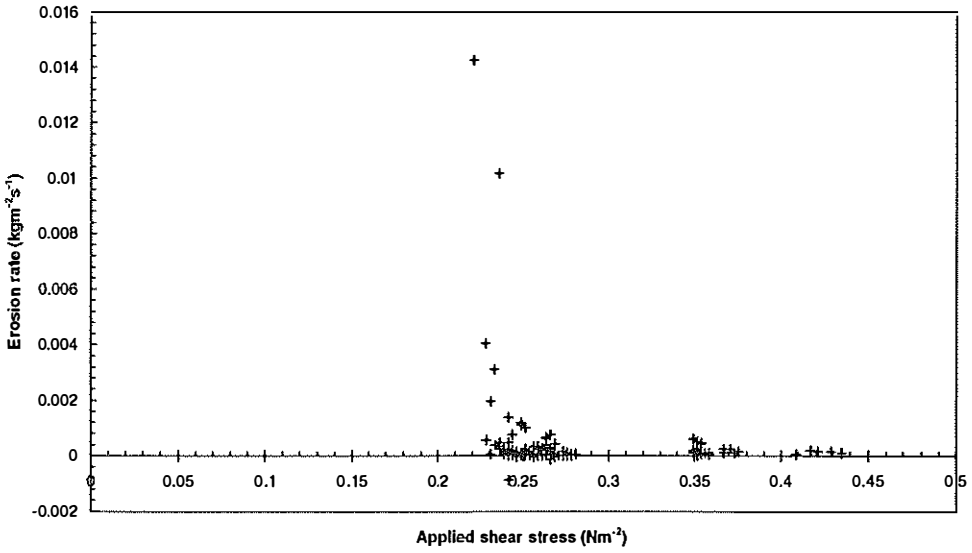


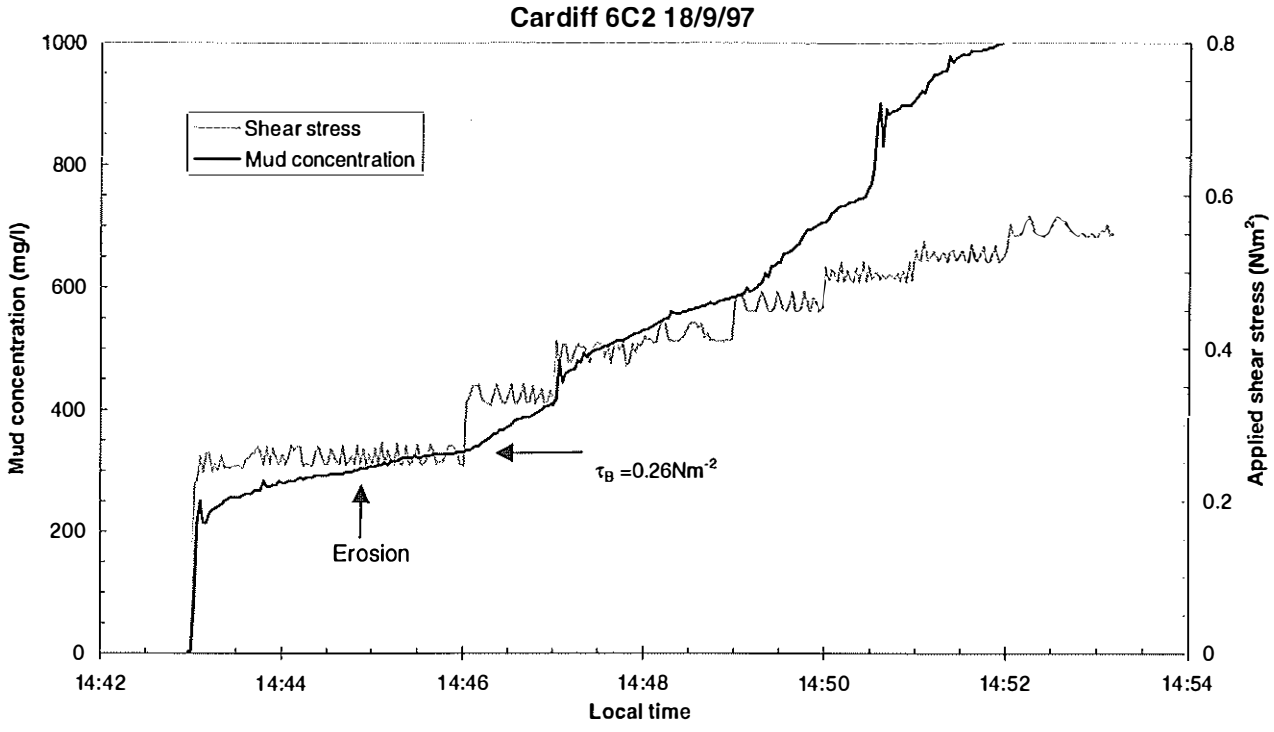

**Site:** **Cardiff seasonal survey September 1997**
Time: 14:24
Date: 18/09/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 14:15 Number: 5


Cardiff 6C1 18/9/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey September 1997**
Time: 14:43
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\csep005.l01

**Site description:**
texture: Very soft surface deposit
colour: Pale brown
covering: Hydrobia (snails)
topography: +/- 1mm
biologically activity: Hydrobia ~10-15/10cm, 2 worms/10cm diameter
composition: Mud, hydrobia
other features: Disturbed soft surface on introduction of water

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 243 | % of dry weight |
| Bulk density: | 1232 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 10.78 | % by weight |
| Median size d50: | 1.88 | microns |
| Sand content: | 1.9 | % by weight |
| Silt content: | 47.0 | % by weight |
| Clay content: | 51.1 | % by weight |
| Mud Temperature: | 22.5 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 0.9
1.0
0.9
1.0
0.9
Average: 0.9

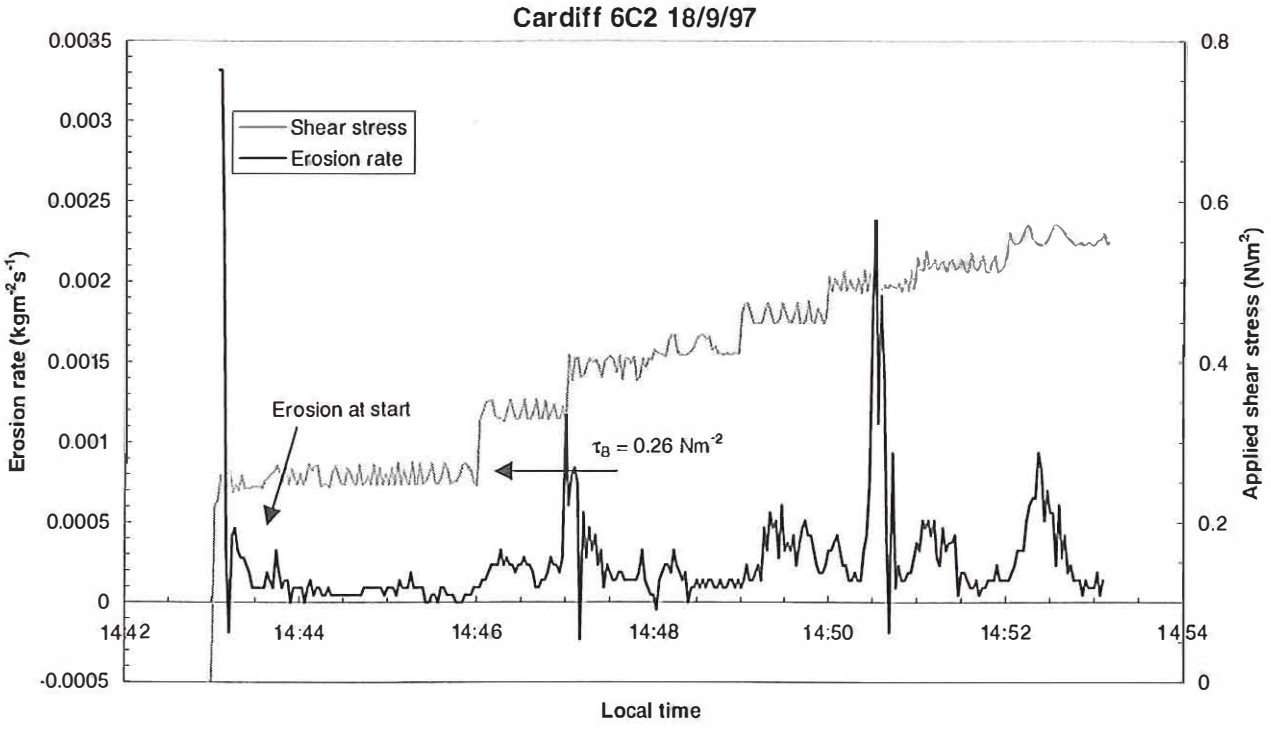
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 14:34 Number: 7

**Comments:**

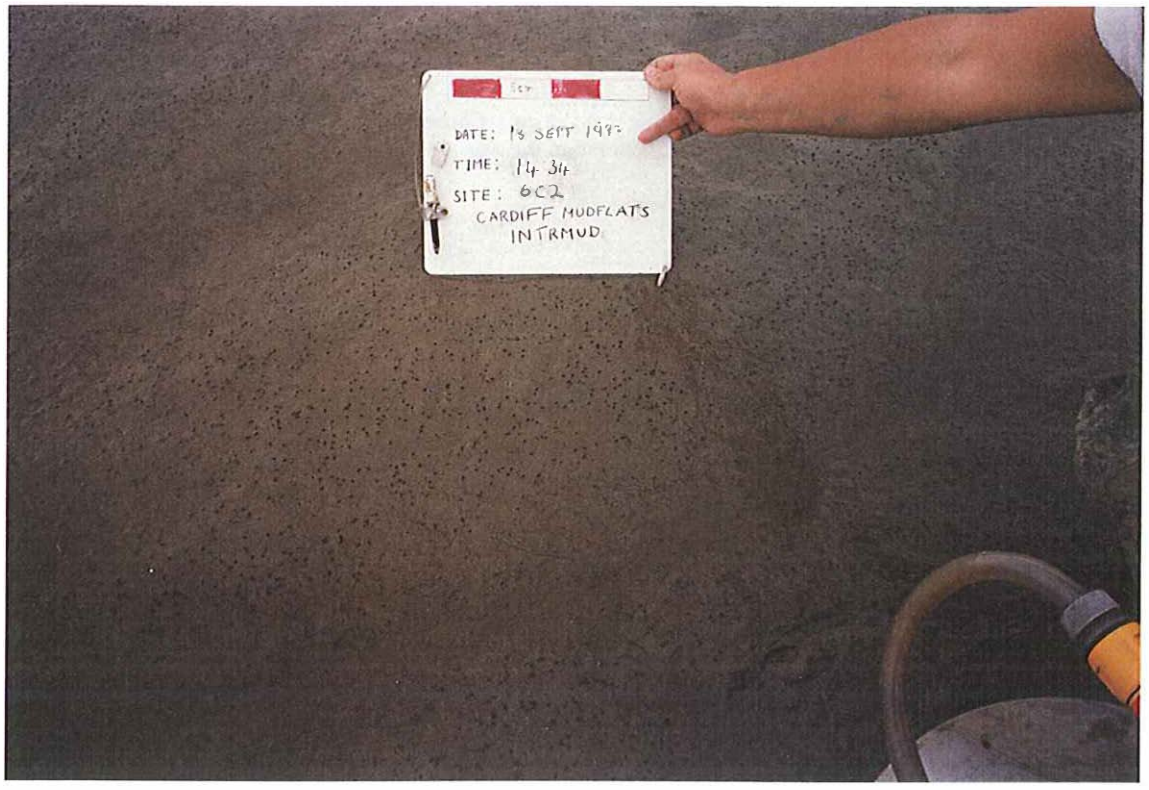
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

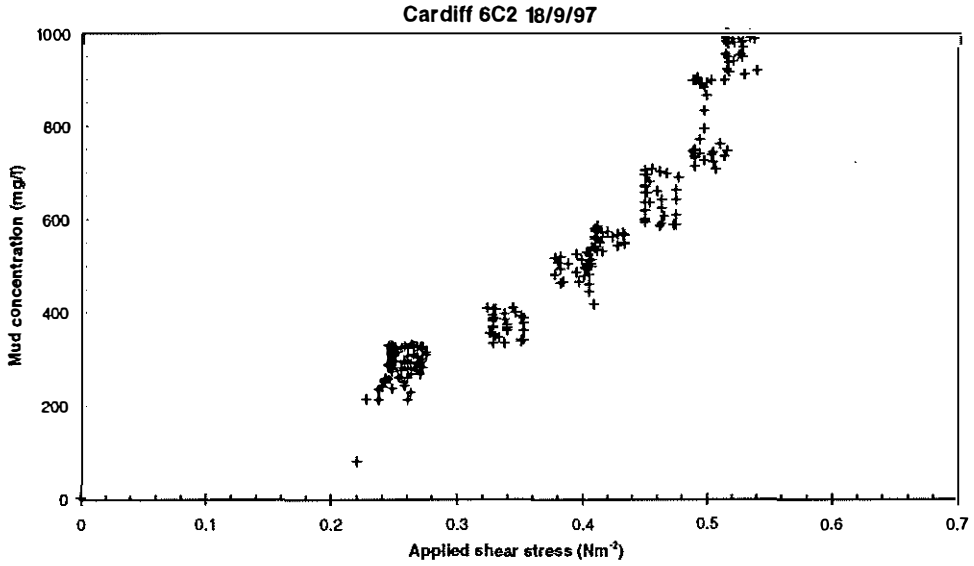
| | | |
|---|---|---|
| $\tau_A$ = | 0.00 | Nm$^{-2}$ |
| $\tau_B$ = | 0.26 | Nm$^{-2}$ |
| Average = | 0.13 | Nm$^{-2}$ |

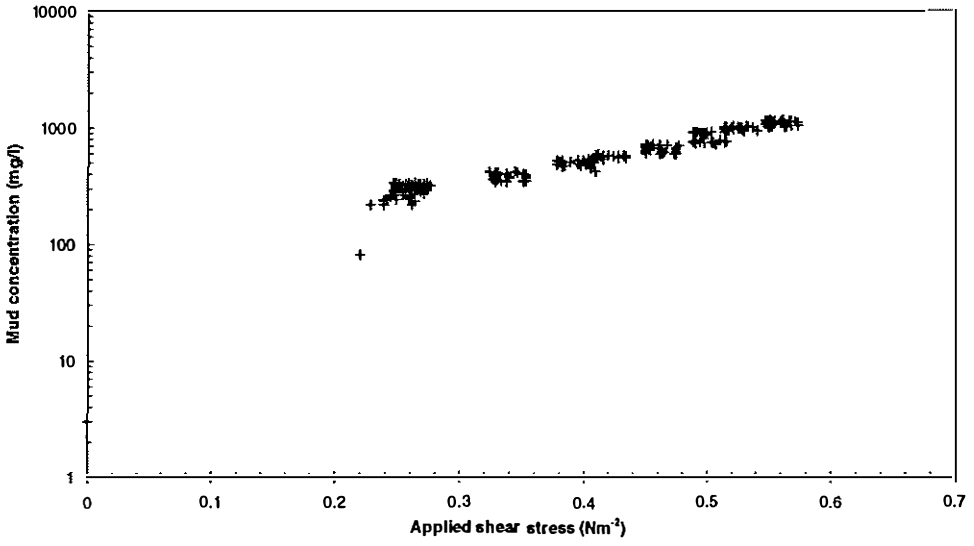


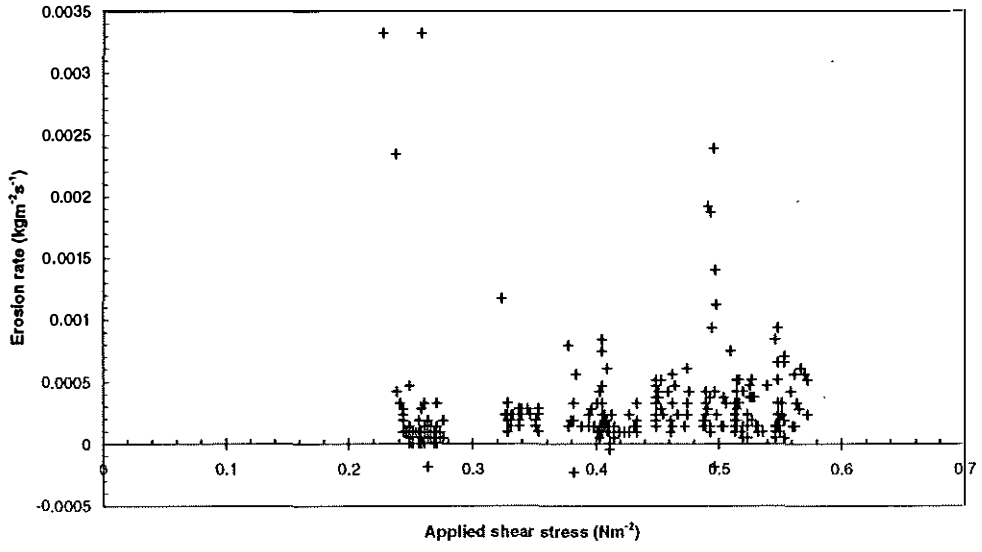

**Site:** **Cardiff seasonal survey September 1997**
Time: 14:43
Date: 18/09/97
Operator: H.J.Mitchener

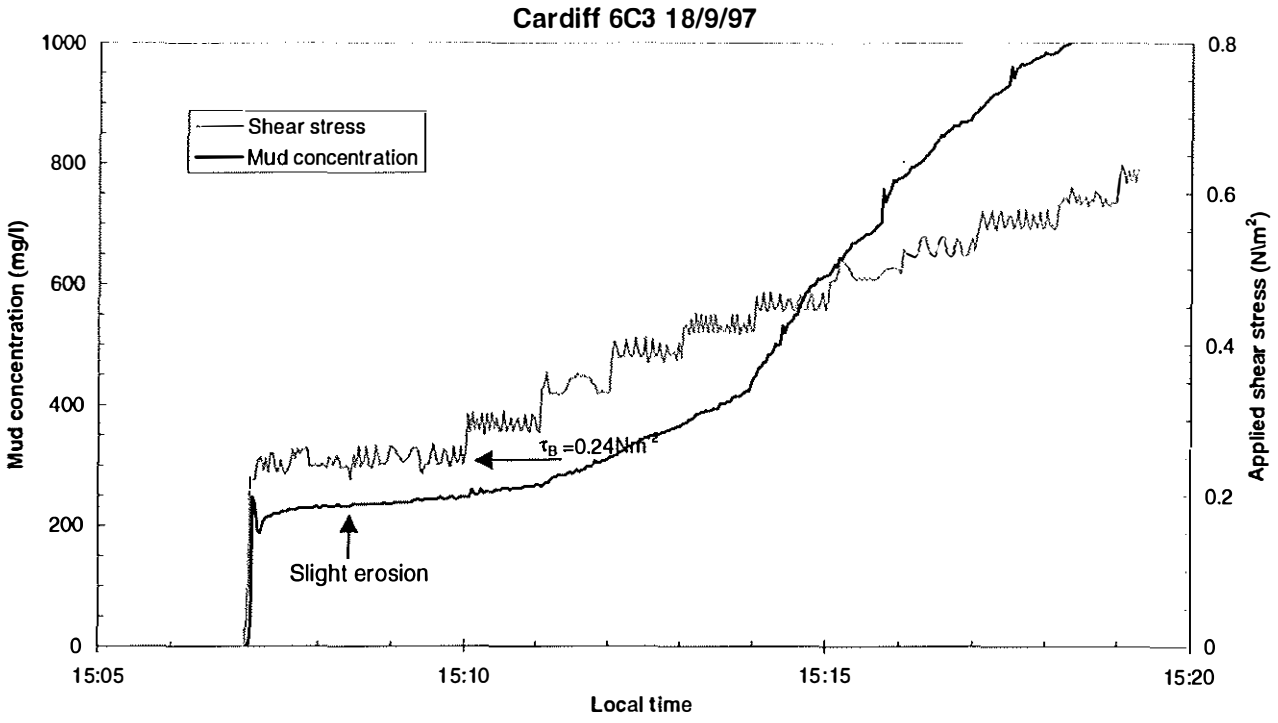
**Photographs:** Film: 1
Time: 14:34 Number: 7




Cardiff 6C2 18/9/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
-0.0005
0.1
0.2
0.3
0.4
0.5
0.6
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey September 1997**
Time: 15:07
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\csep006.l01

**Site description:**

texture: Soft. Drier than 6C2
colour: Pale brown
covering: Scant water, hydrobia
topography: +/- 2mm, hydrobia snails
biologically activity: Hydrobia ~20/10cm, 3 worms/10cm diameter
composition: Mud, hydrobia
other features: Short rain shower, then windy and sunny

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 240 | % of dry weight |
| Bulk density: | 1234 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.75 | % by weight |
| Median size d50: | 1.75 | microns |
| Sand content: | 2.0 | % by weight |
| Silt content: | 46.0 | % by weight |
| Clay content: | 52.0 | % by weight |
| Mud Temperature: | 24 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.1
1.2
1.1
1.2
1.1
Average: 1.1

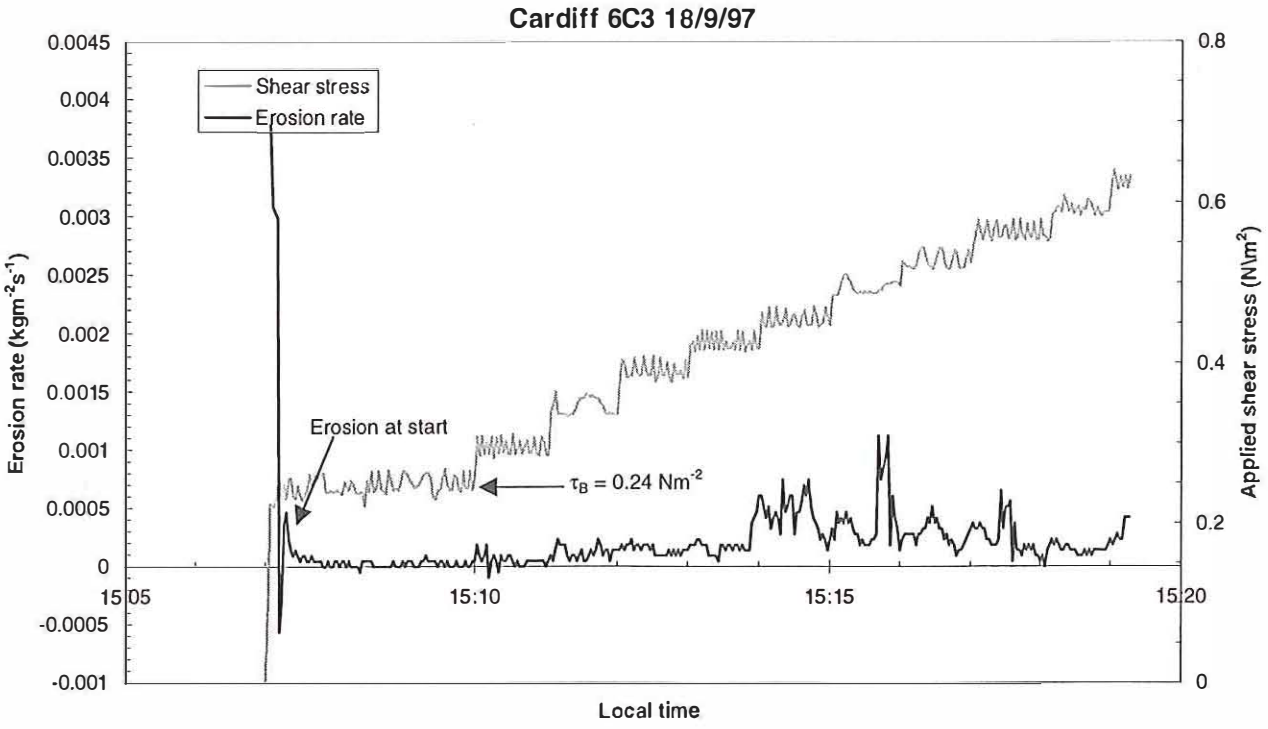
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 15:00 Number: 10

**Comments:** Surface layer erosion at first applied shear stress

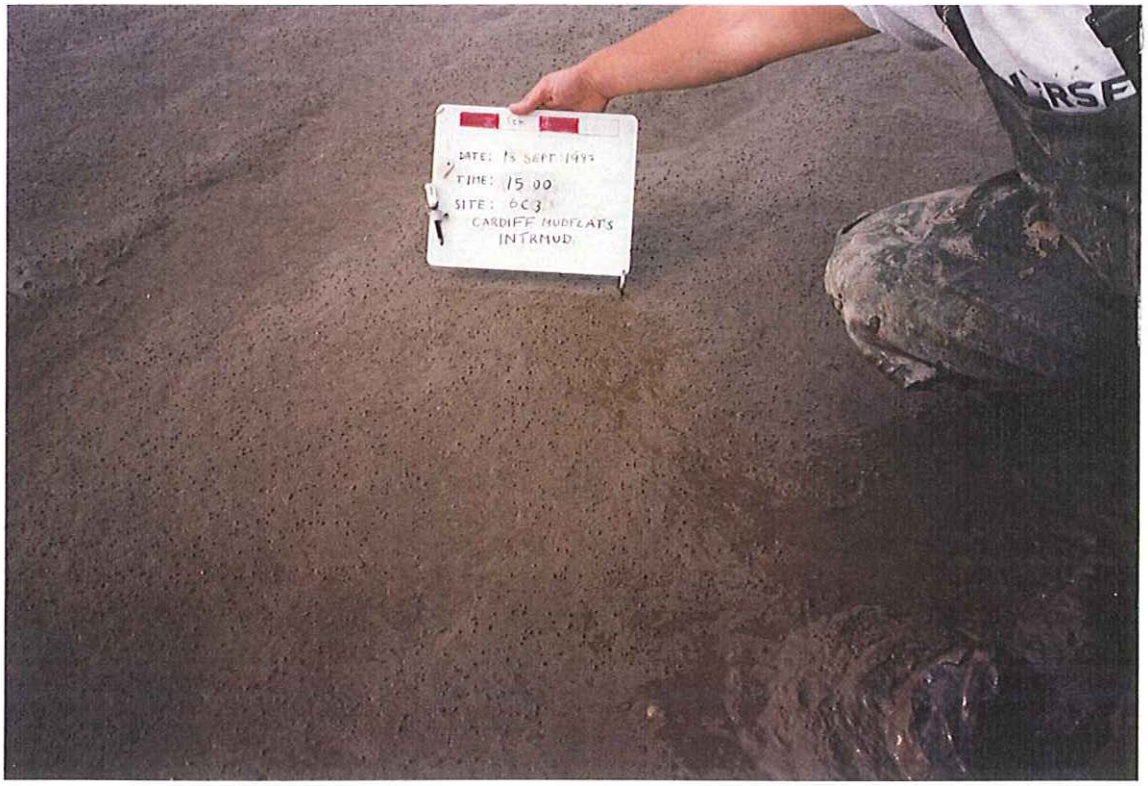
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

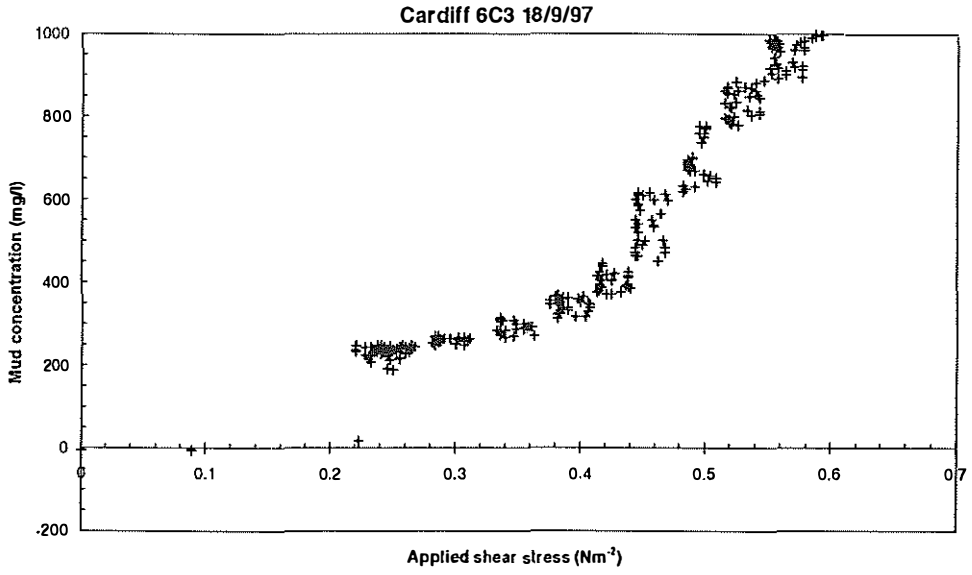
| | | |
|---|---|---|
| $\tau_A$ = | 0.00 | Nm$^{-2}$ |
| $\tau_B$ = | 0.24 | Nm$^{-2}$ |
| Average = | 0.12 | Nm$^{-2}$ |

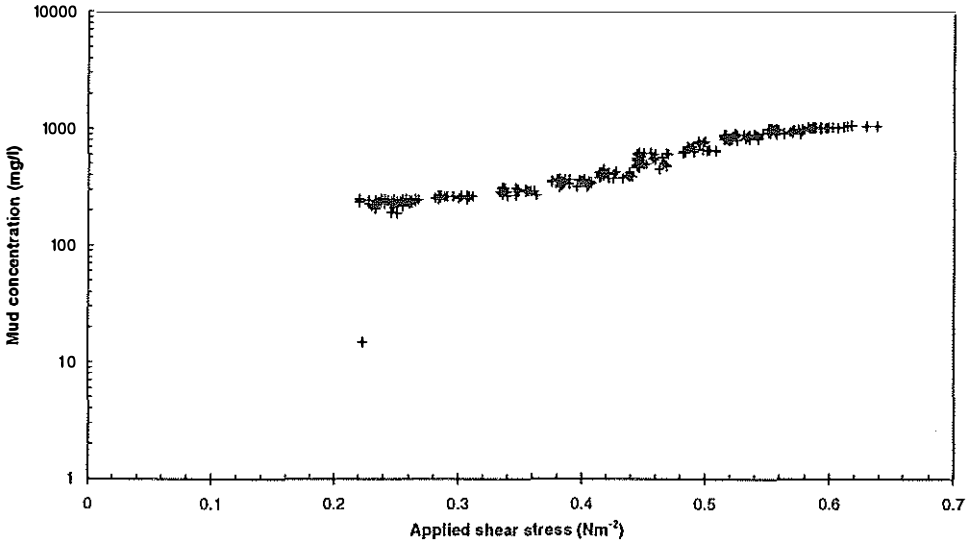


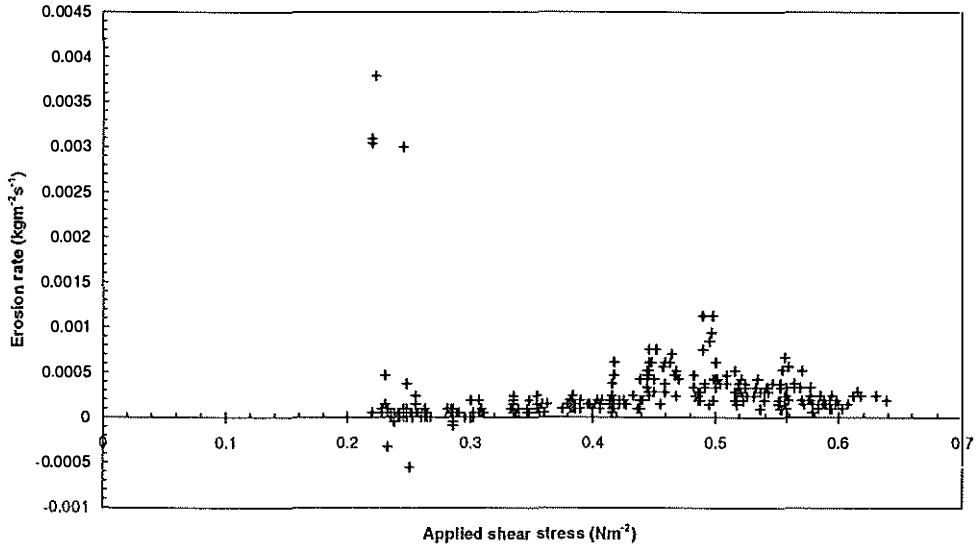

**Site:** **Cardiff seasonal survey September 1997**
Time: 15:07
Date: 18/09/97
Operator: H.J.Mitchener

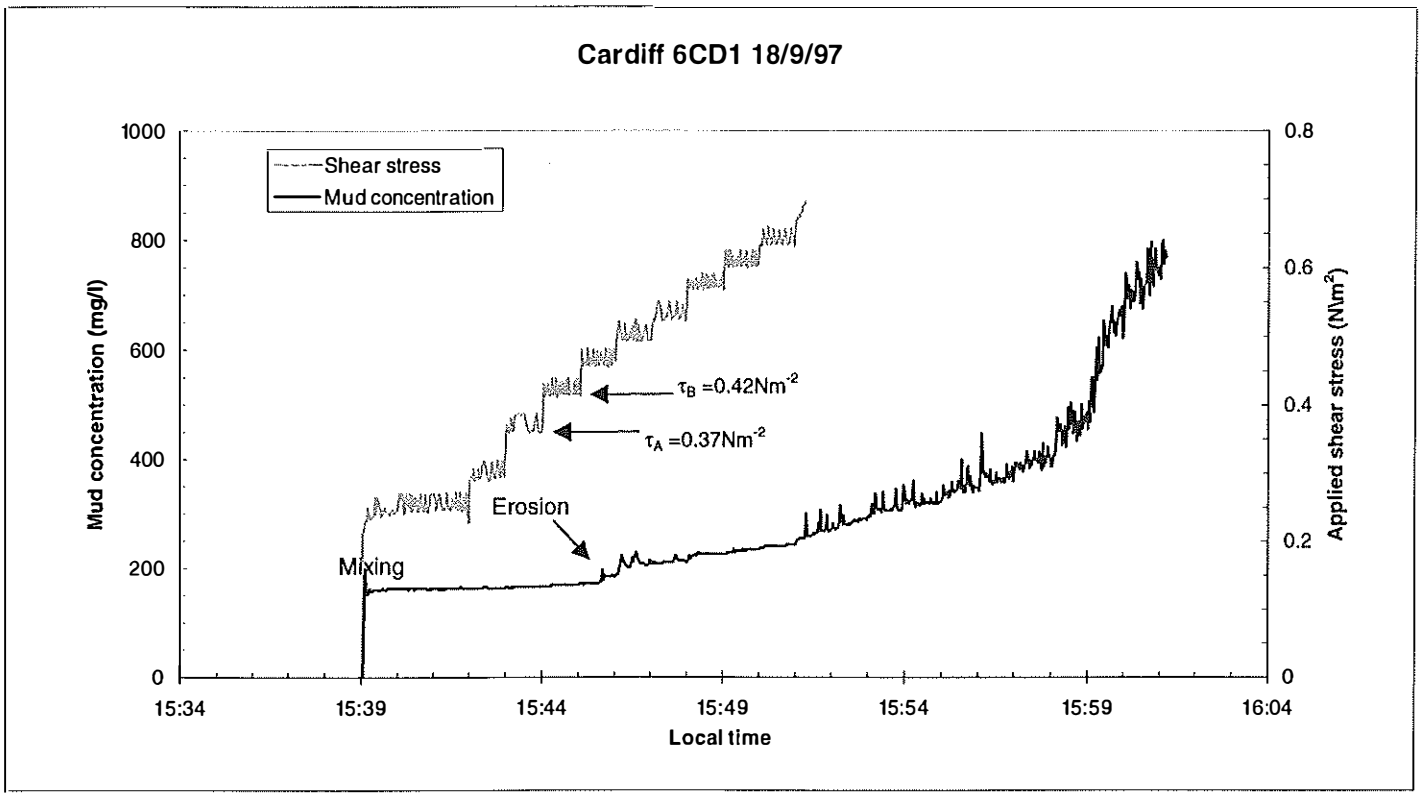
**Photographs:** Film: 1
Time: 15:00 Number: 10




Cardiff 6C3 18/9/97
Mud concentration (mg/l)
1000
800
600
400
200
0
-200
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
-0.0005
-0.001
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey September 1997**
Time: 15:39
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\csep007.l01

**Site description:**
texture: Medium soft, much harder than C
colour: Pale brown
covering: Dry, few hydrobia & pore holes
topography: +/- 1mm, pore holes
biologically activity: Hydrobia ~15/10cm, 30 worms/10cm diameter
composition: Mud, scant sand
other features: Dry & sunny

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 152 | % of dry weight |
| Bulk density: | 1332 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.42 | % by weight |
| Median size d50: | 2.82 | microns |
| Sand content: | 1.4 | % by weight |
| Silt content: | 54.9 | % by weight |
| Clay content: | 43.7 | % by weight |
| Mud Temperature: | 22 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.4, 1.4, 1.2, 1.1, 1.4
Average: 1.3

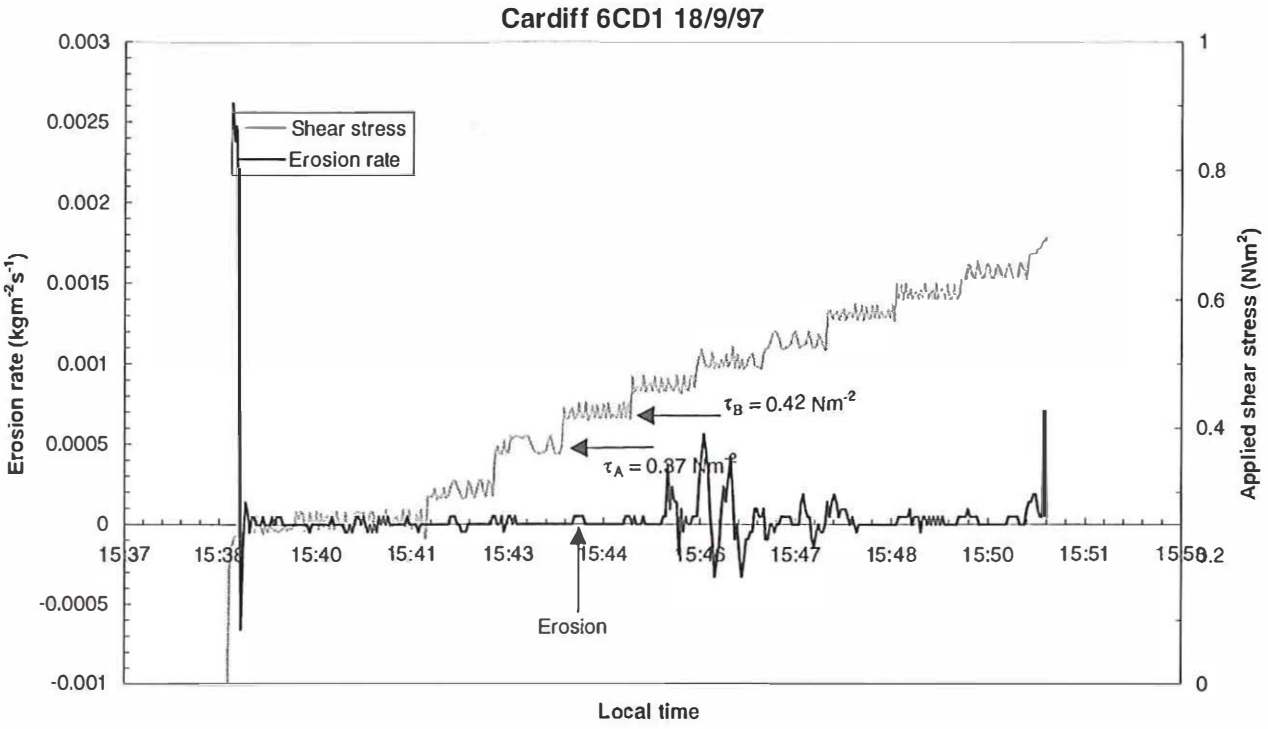
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 15:31 Number: 15
Time: Number: 17, 18, 19 after erosion

**Comments:**

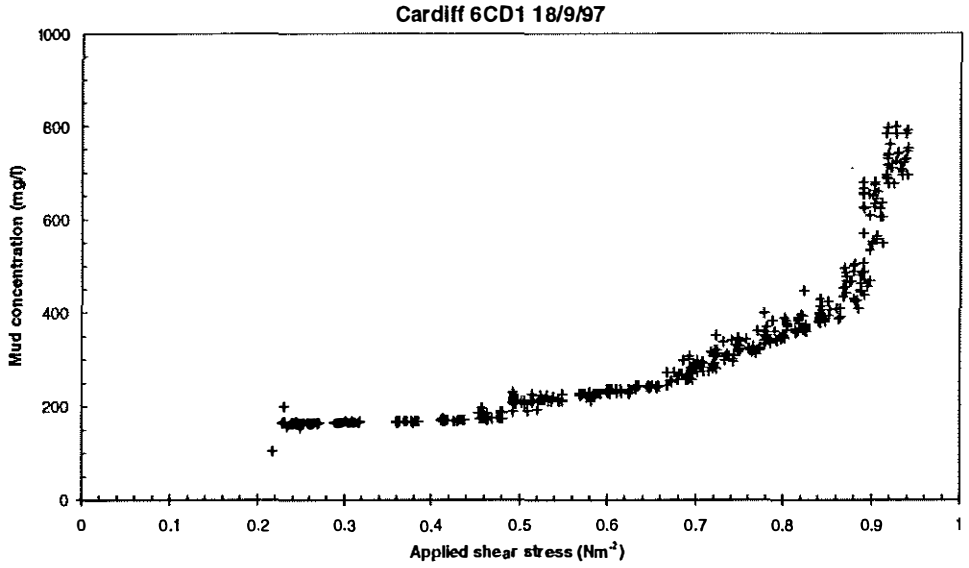
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

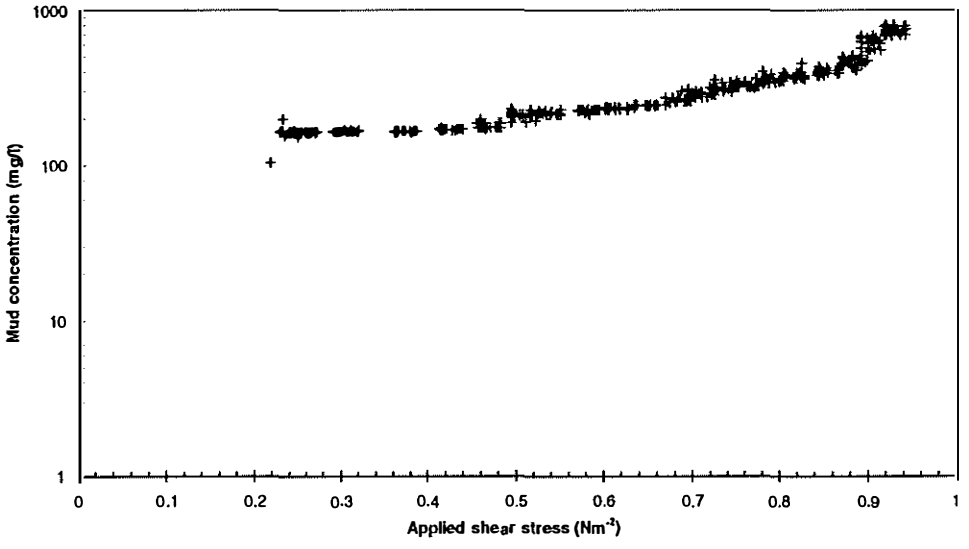
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.37** | **Nm$^{-2}$** |
| **$\tau_B$ =** | **0.42** | **Nm$^{-2}$** |
| **Average =** | **0.40** | **Nm$^{-2}$** |

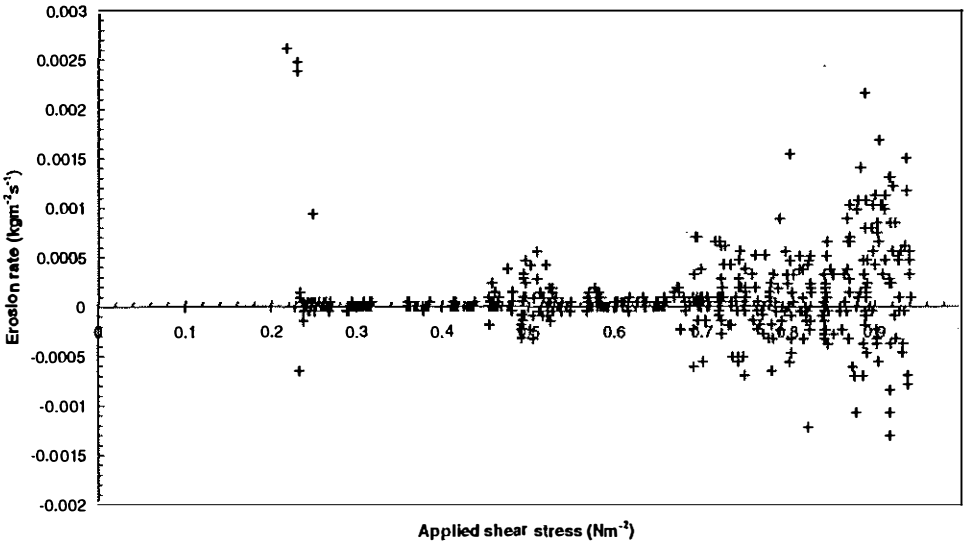


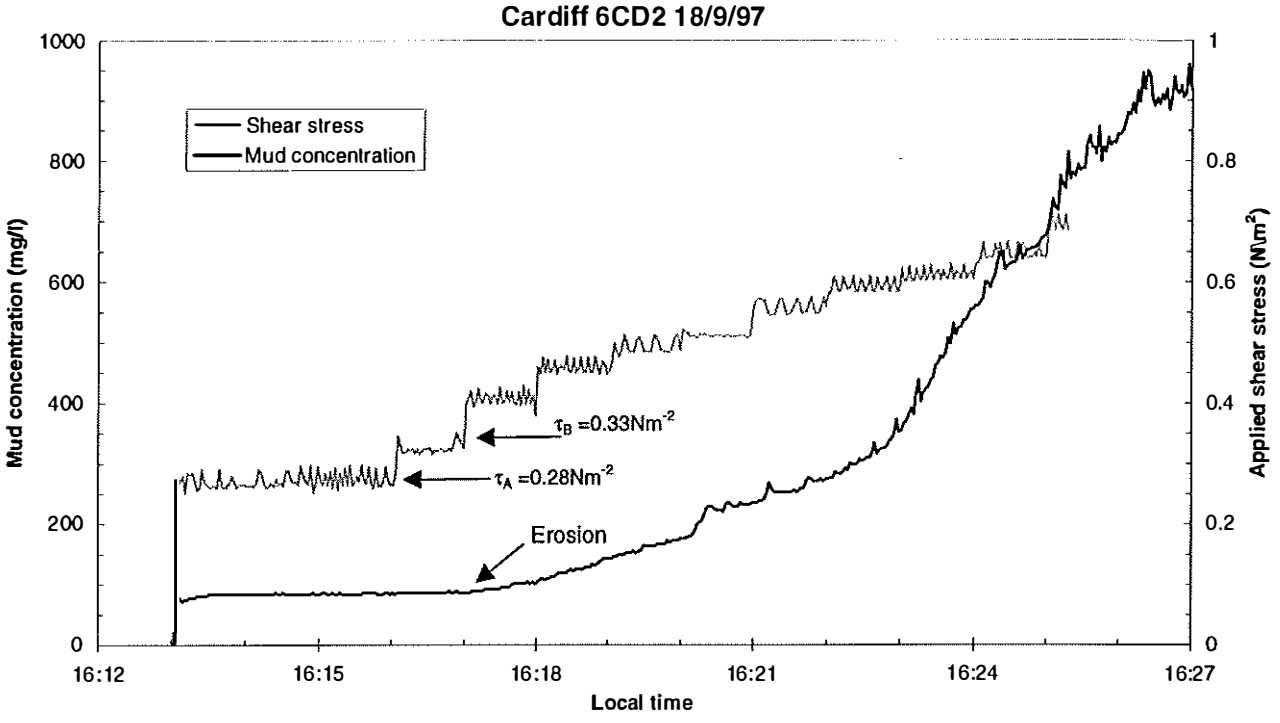

**Site:** **Cardiff seasonal survey September 1997**
Time: 15:39
Date: 18/09/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 15:31 Number: 15
Time: Number: 17, 18, 19 after erosion


Cardiff 6CD1 18/9/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
-0.0005
-0.001
-0.0015
-0.002
0.1
0.2
0.3
0.4
0.6
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey September 1997**
Time: 16:13
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\csep008.l01

**Site description:**
texture: Medium
colour: Pale brown
covering: Pore holes, hydrobia
topography: +/- 2mm, pore holes
biologically activity: Hydrobia ~20-25, 2 worms, 10 pore holes/10cm D
composition: Mud, scant sand
other features: Dry, sunny & windy

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 138 | % of dry weight |
| Bulk density: | 1356 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 8.84 | % by weight |
| Median size d50: | 2.78 | microns |
| Sand content: | 3.9 | % by weight |
| Silt content: | 51.7 | % by weight |
| Clay content: | 44.4 | % by weight |
| Mud Temperature: | 23.5 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.0
1.7
1.7
1.7
1.6
Average: 1.5

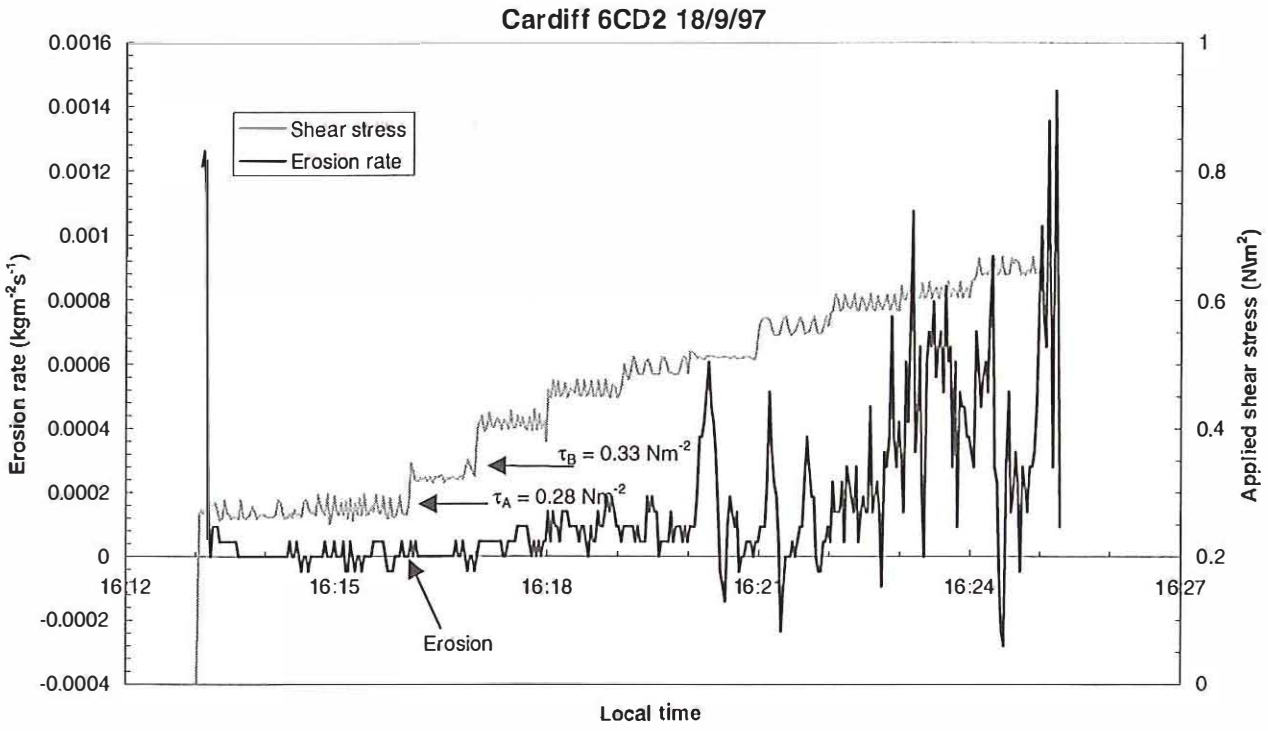
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 16:05 Number: 16
Time: Number: 22,23 after erosion

**Comments:**

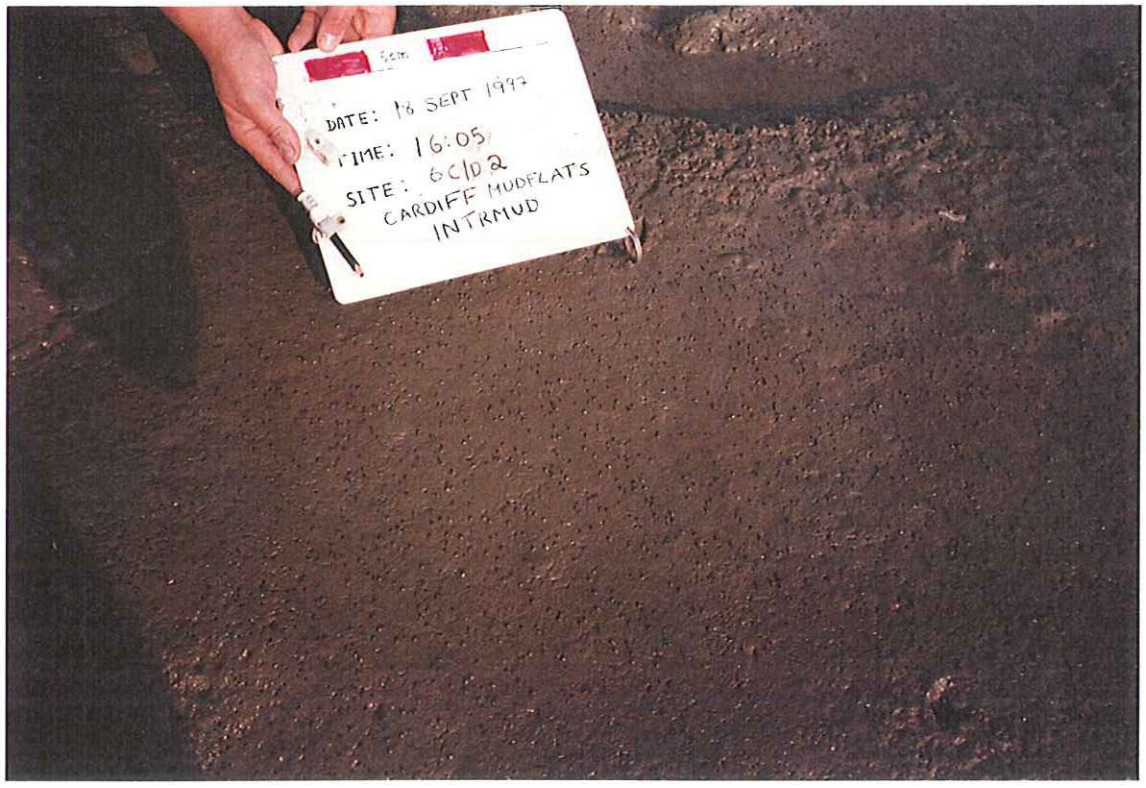
**Critical erosion shear stress between $\tau_a$ & $\tau_b$**

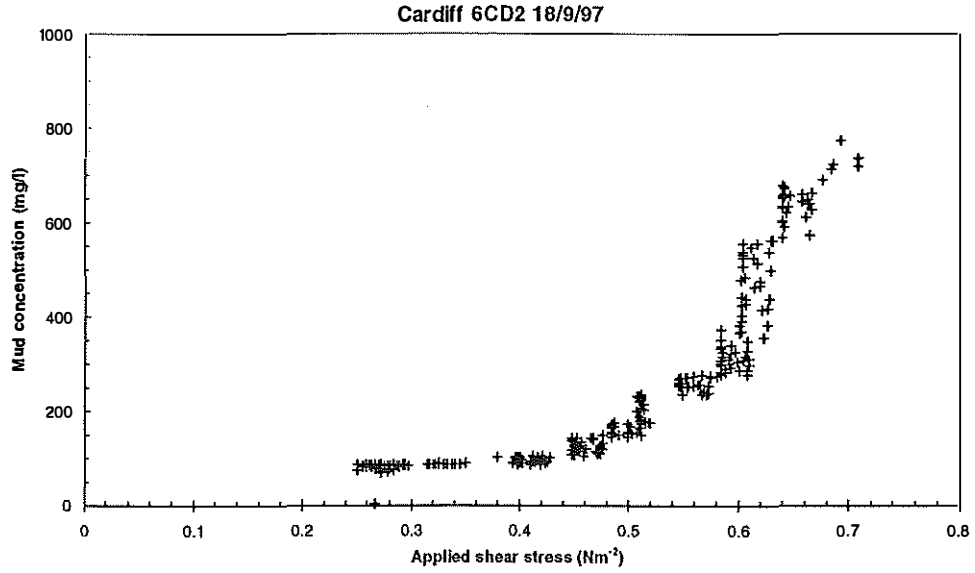
| | | |
|---|---|---|
| $\tau_a$ = | 0.28 | Nm$^{-2}$ |
| $\tau_b$ = | 0.33 | Nm$^{-2}$ |
| Average = | 0.31 | Nm$^{-2}$ |

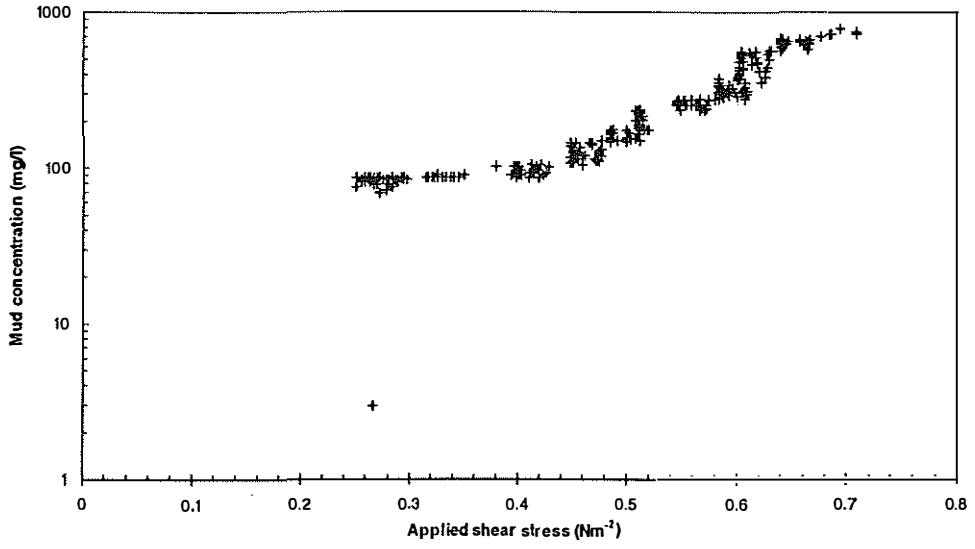


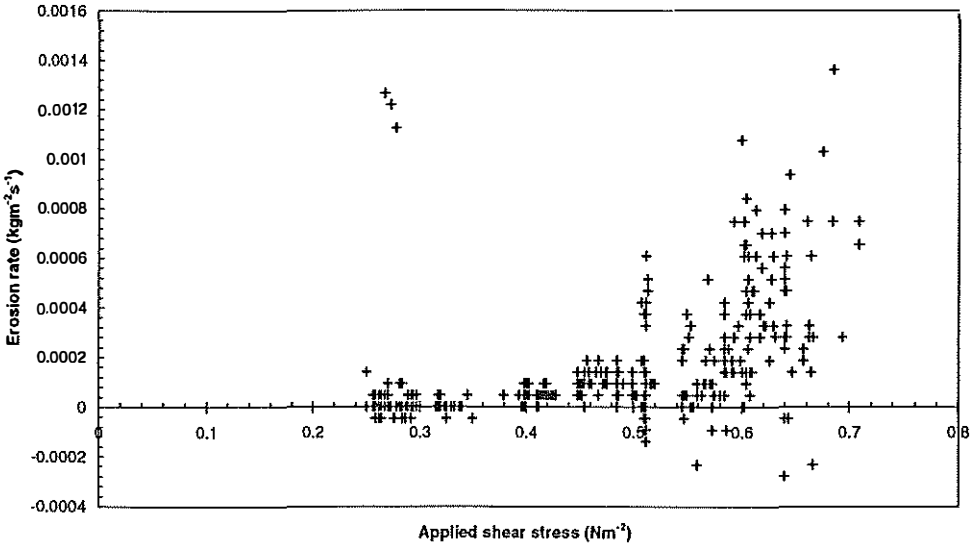

**Site:** **Cardiff seasonal survey September 1997**
Time: 16:13
Date: 18/09/97
Operator: H.J.Mitchener

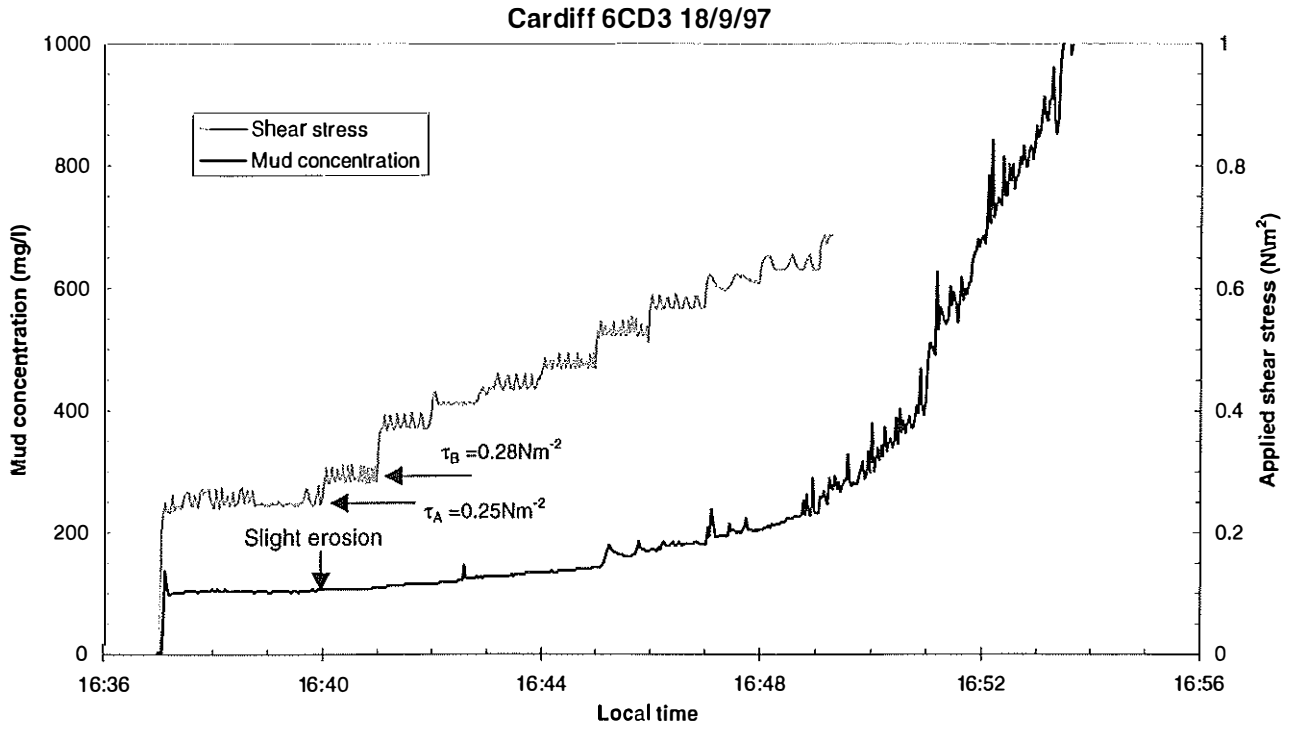
**Photographs:** Film: 1
Time: 16:05 Number: 16
Time: Number: 22,23




Cardiff 6CD2 18/9/97
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
-0.0002
-0.0004
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Applied shear stress (Nm-2)




**Site:** **Cardiff seasonal survey September 1997**
Time: 16:37
Date: 18/09/97
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\csep009.l01

**Site description:**
texture: Medium
colour: Pale brown
covering: Hydrobia, worm tracks & pore holes
topography: +/- 2mm, pore holes
biologically activity: Hydrobia ~20, 3 worms/10cm diameter
composition: Mud, hydrobia
other features: Feels softer than 6CD2

**Surface sample:** (from top 5mm) -

| | | |
|---|---|---|
| Water content: | 137 | % of dry weight |
| Bulk density: | 1358 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 8.65 | % by weight |
| Median size d50: | 2.40 | microns |
| Sand content: | 3.3 | % by weight |
| Silt content: | 49.7 | % by weight |
| Clay content: | 47.0 | % by weight |
| Mud Temperature: | 22 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.3, 1.2, 1.3, 1.2, 1.5
Average: 1.3

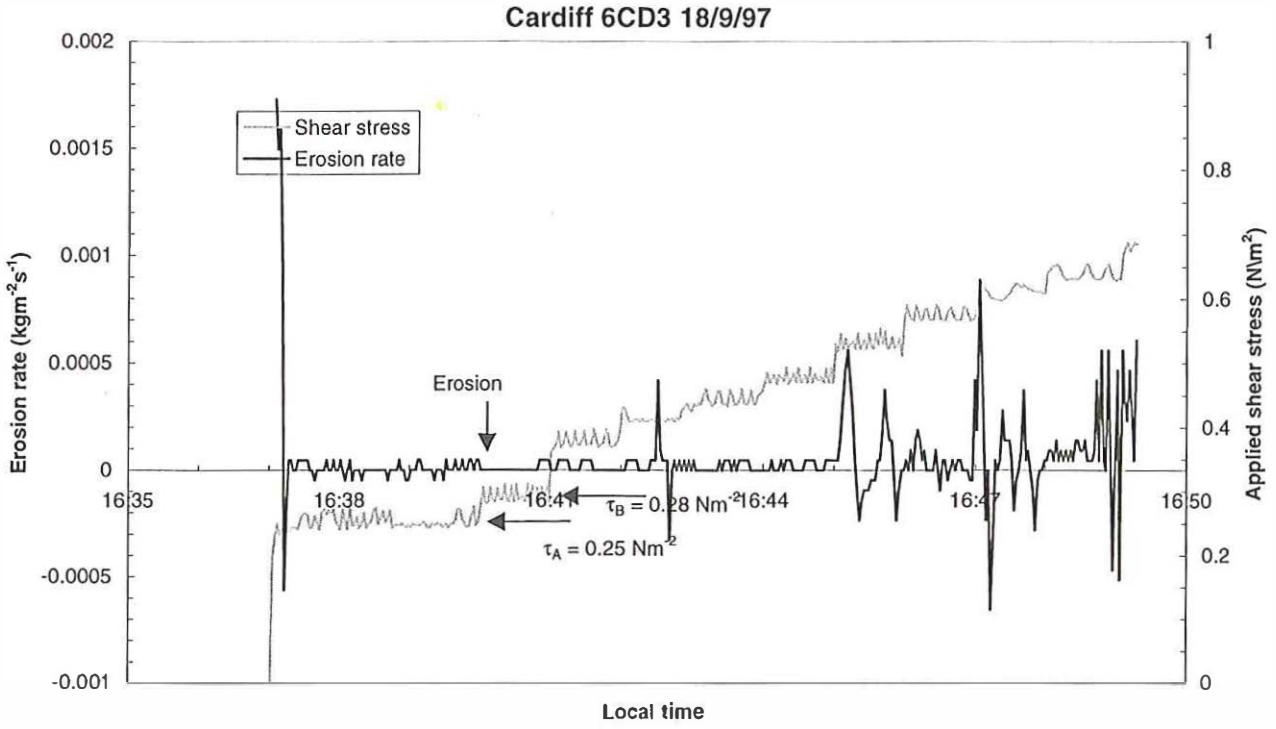
**Eroding Water:** (local collected at HW)
Salinity : 24.97

**Photographs:** Film: 1
Time: 16:31 Number: 21

**Comments:**

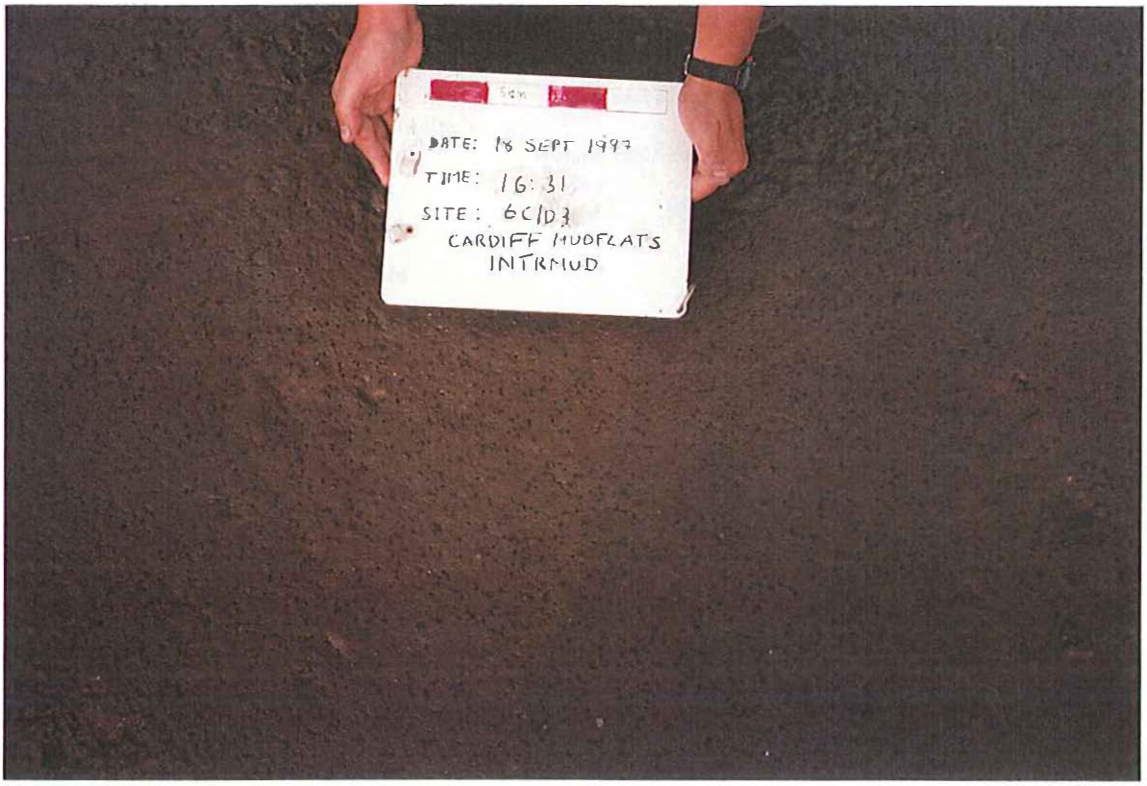
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

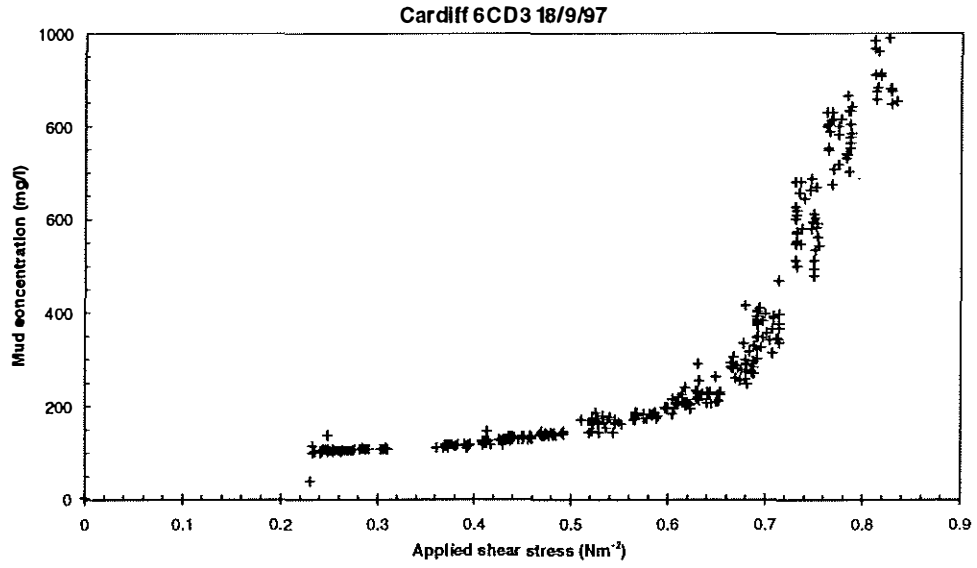
| | | |
|---|---|---|
| $\tau_A$ = | 0.25 | Nm$^{-2}$ |
| $\tau_B$ = | 0.28 | Nm$^{-2}$ |
| Average = | 0.27 | Nm$^{-2}$ |

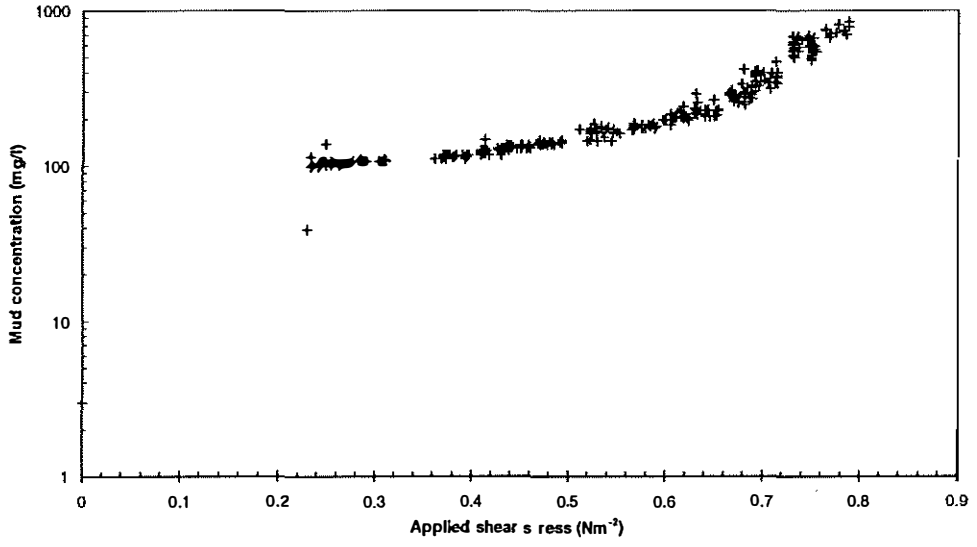


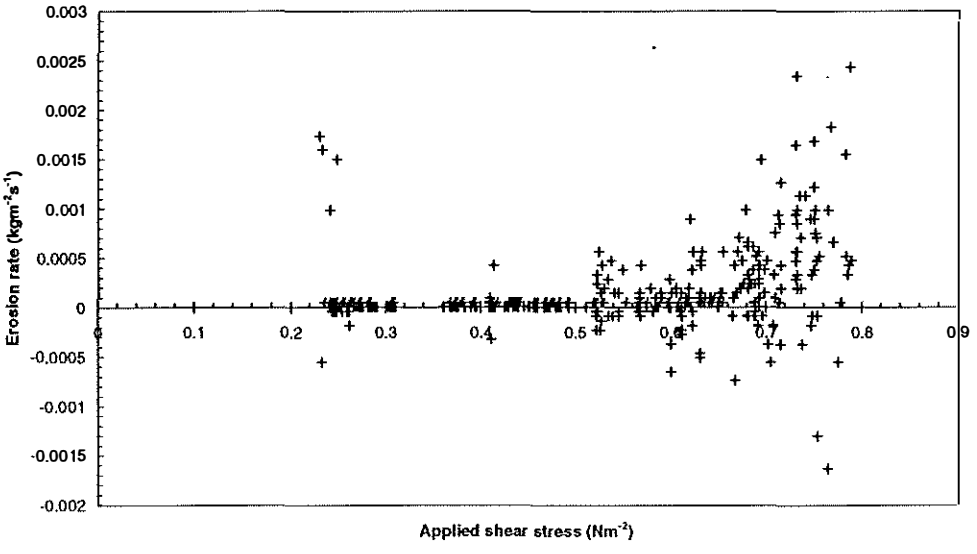

**Site:** **Cardiff seasonal survey September 1997**
Time: 16:37
Date: 18/09/97
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 16:31 Number: 21



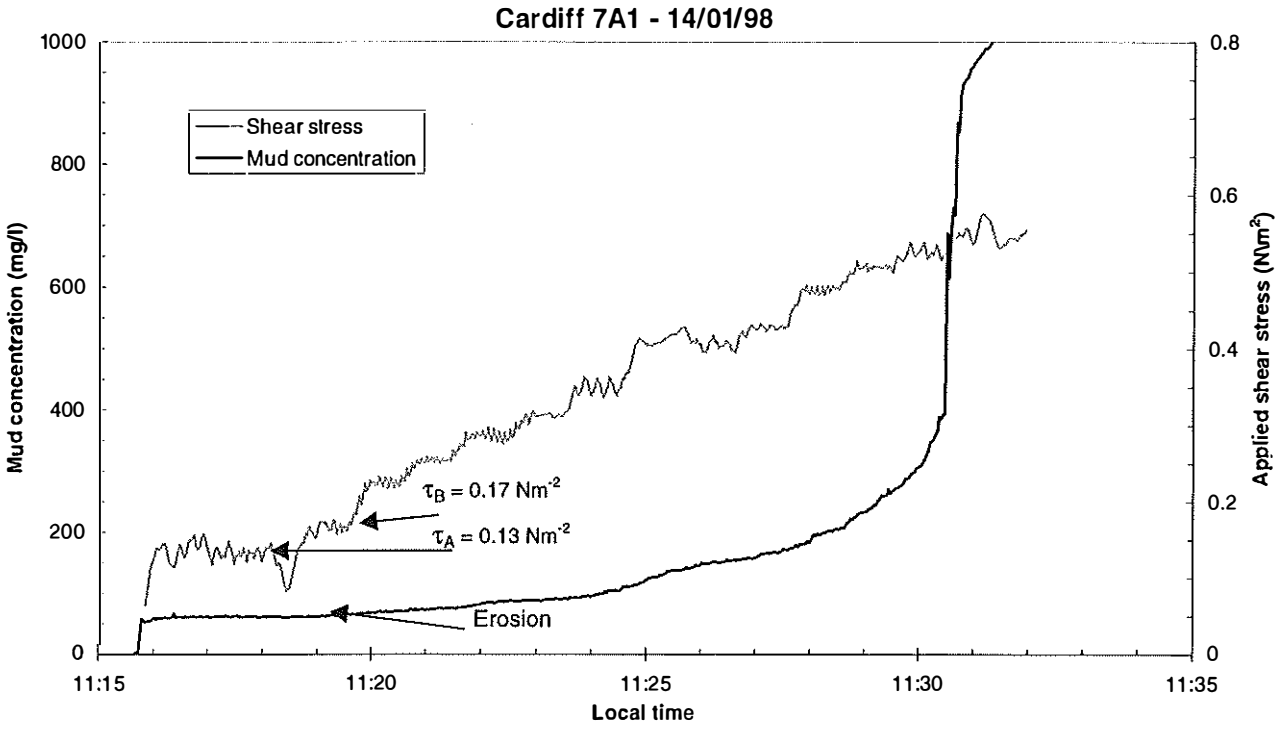

Cardiff 6CD3 18/9/97
Mud concentration (mg/l)
1000
600
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
10
1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear s ress (Nm-2)


Erosion rate (kgm-2s-1)
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
-0.0005
-0.001
-0.0015
-0.002
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)

# SedErode Data Plots

# Cardiff January 1998




**Site:** **Cardiff winter survey January 98**
Time: 10:58
Date: 14/01/98
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjan\cjan001

**Site description:**
texture: Medium soft - homogenous gritty
colour: brown with green hue
covering: scant water, some black debris
topography: +/- 2mm Fladrian clay exposed in places
biologically activity: Birds prints 1-2/10cm diam, no hydrobia,no worms
composition: mud, very scant fine sand
other features: large flock of birds, at this site earlier in day

**Surface sample:** (from top 5mm) - 7A1

| | | |
|---|---|---|
| Water content: | 215 | % of dry weight |
| Bulk density: | 1255 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 10.02 | % by weight |
| Median size d50: | 4.61 | microns |
| Sand content: | 0.0 | % by weight |
| Silt content: | 78.0 | % by weight |
| Clay content: | 22.0 | % by weight |
| Mud Temperature: | 8 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 1.2, 1.5, 1.3, 1.6, 1.6
Average: 1.4

**Eroding Water:** (local collected at HW)
Salinity : 20

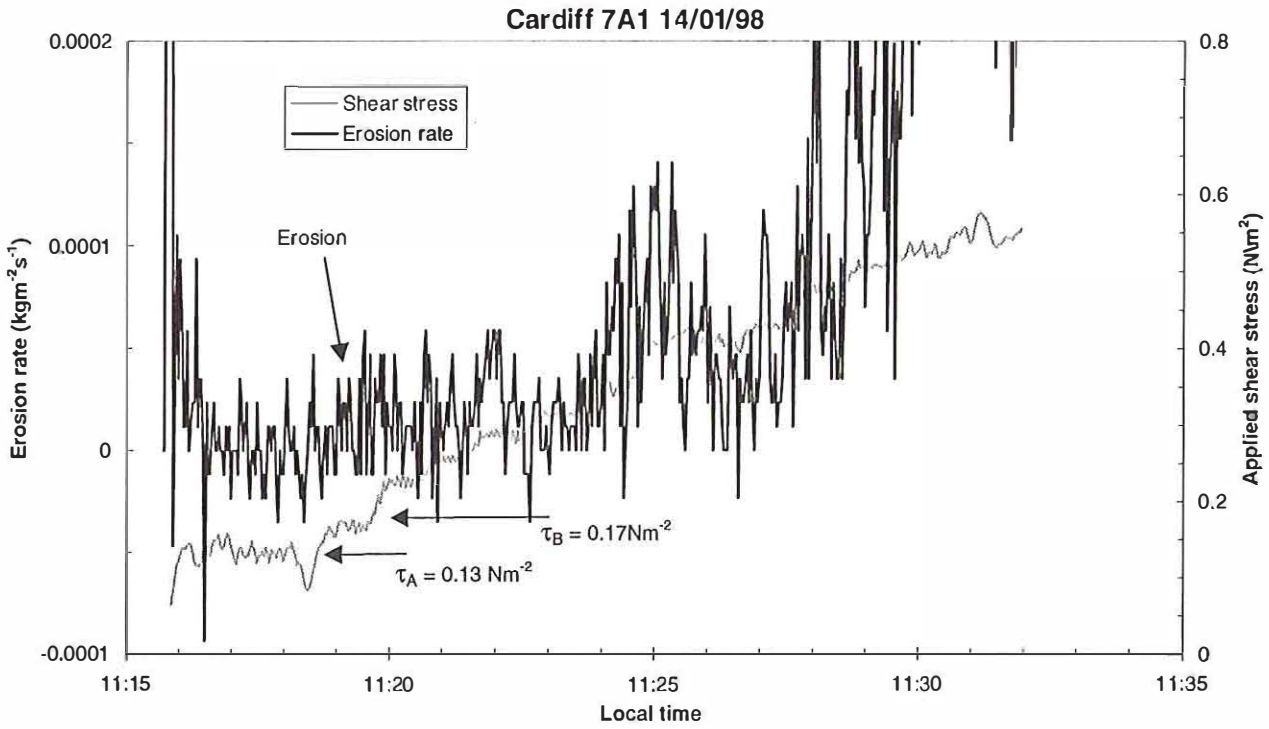
**Photographs:**

| | | | |
|---|---|---|---|
| Time: 10:57 | Film: | 1 | |
| | Number: | 2 | 7A1 before erosion |
| | | 4 | 7A1 after |
| | | 5 | 7A1 after |

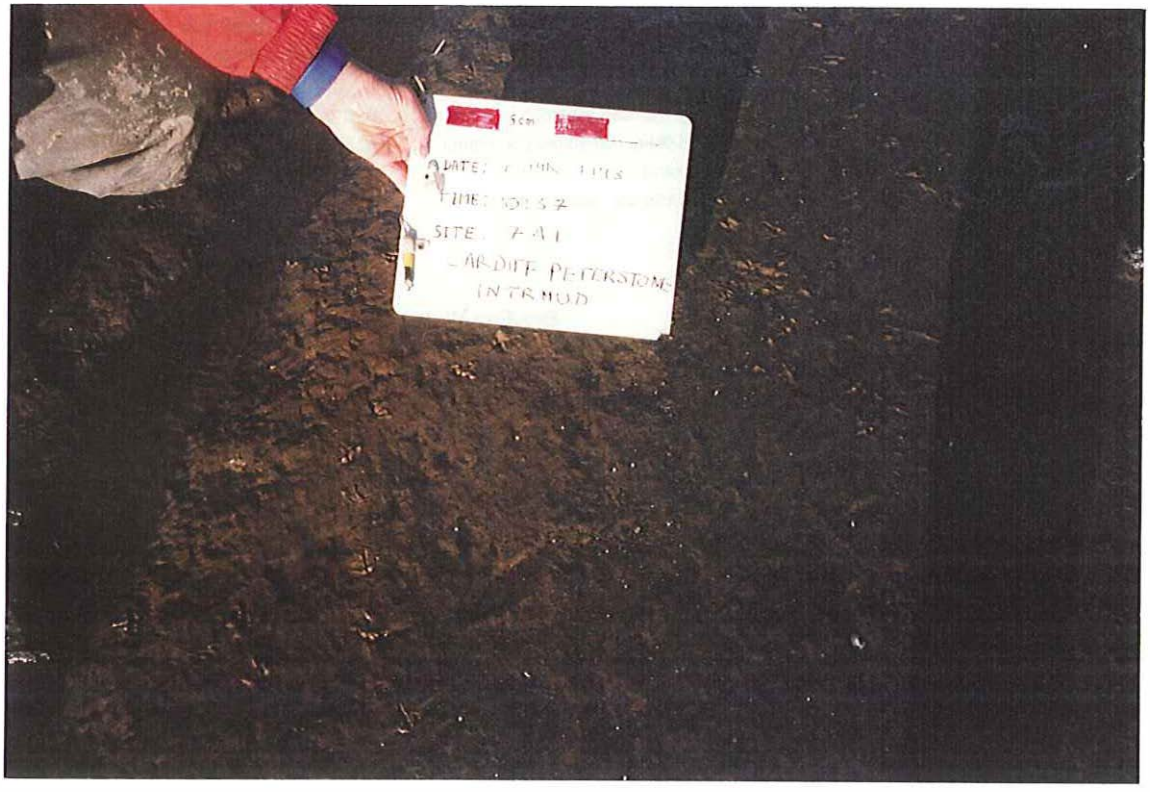
**Comments:** SedErode deployed on soft mud overlying Flandrian clay.

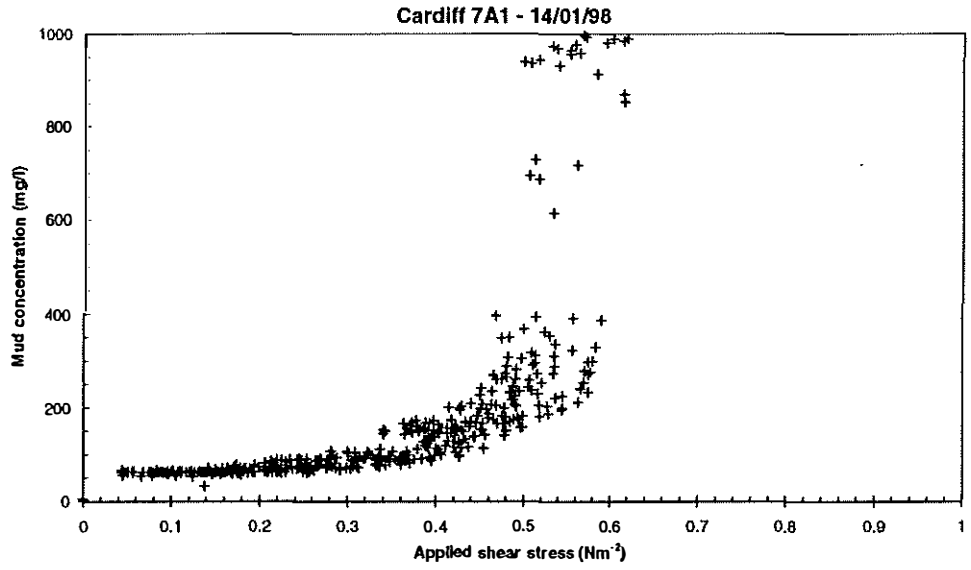
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

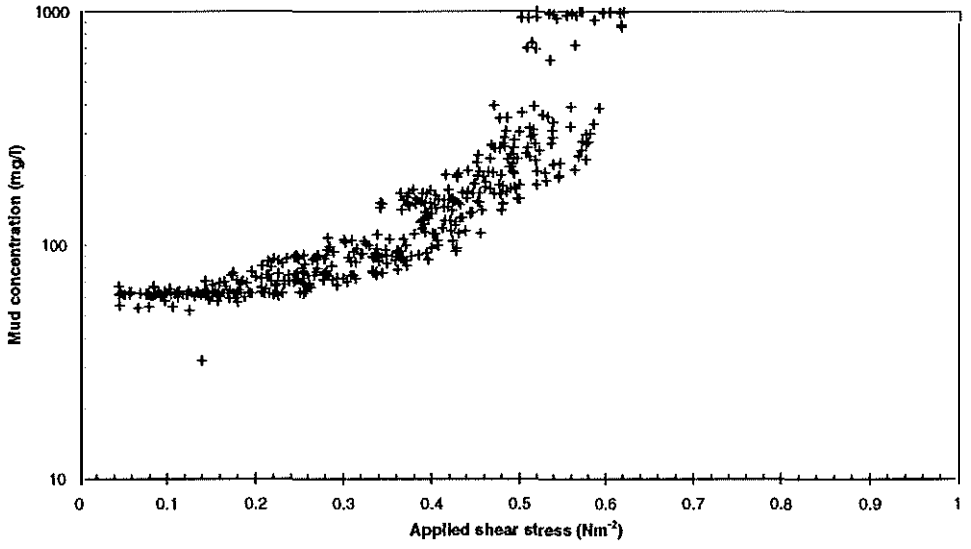
| | | |
|---|---|---|
| $\tau_A$ = | **0.13** | **$Nm^{-2}$** |
| $\tau_B$ = | **0.17** | **$Nm^{-2}$** |
| **Average =** | **0.15** | **$Nm^{-2}$** |

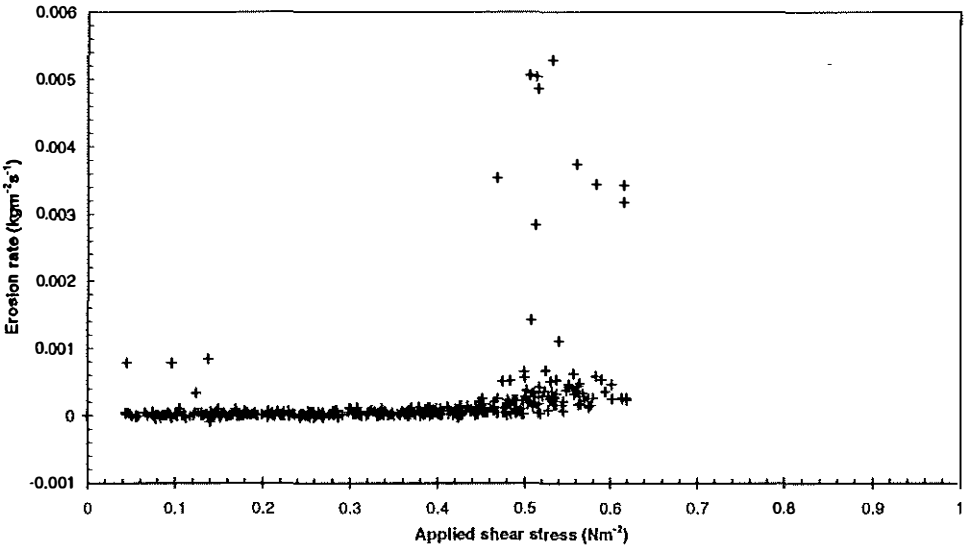


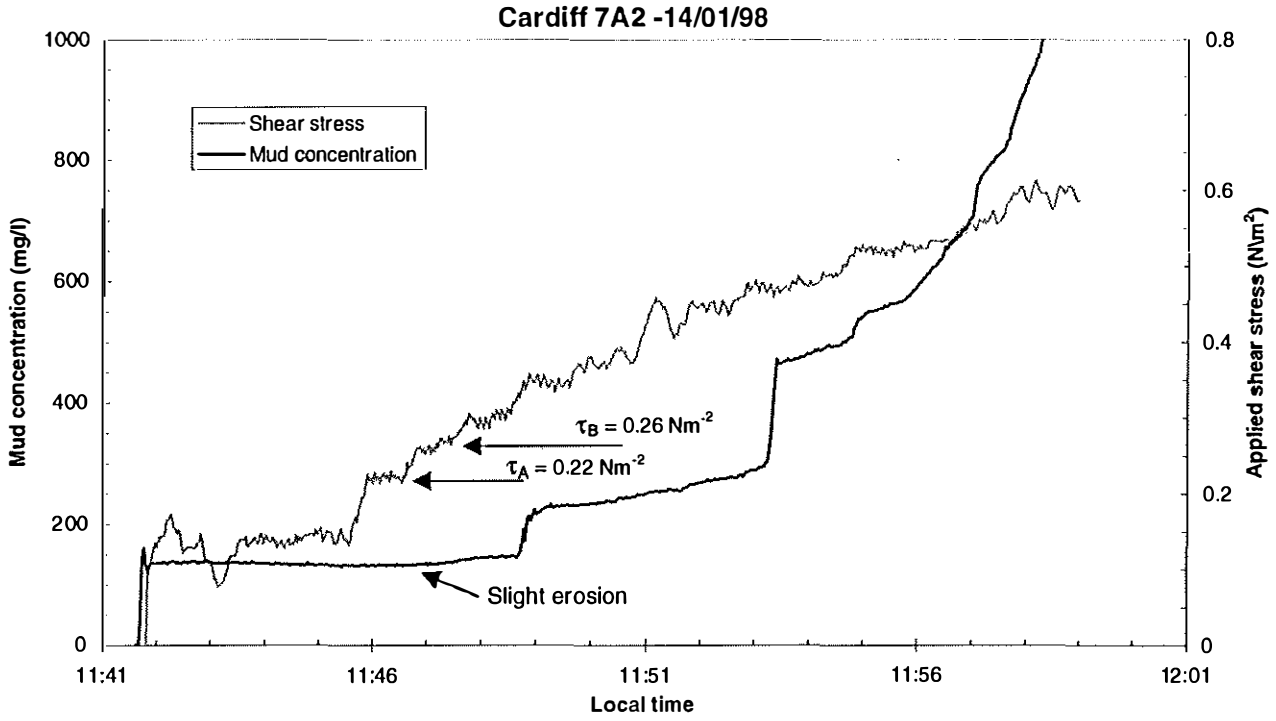

| | | | | | |
|---|---|---|---|---|---|
| **Site:** | **Cardiff winter survey January 98** | **Photographs:** | Film: | 1 | |
| Time: | 10:58 | Time: 10:57 | Number: | 2 | 7A1 before erosion |
| Date: | 14/01/98 | | | 4 | 7A1 after |
| Operator: | H.J.Mitchener | | | 5 | 7A1 after |




Cardiff 7A1 - 14/01/98
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.006
0.005
0.004
0.003
0.002
0.001
0
-0.001
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff winter survey January 98**
Time: 11:37
Date: 14/01/98
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\Cjan\cjan002

**Site description:**
texture: Medium soft, homogenous gritty
colour: brown, some black flecks, green hue
covering: water, black debris
topography: +/- 2mm, undulating
biologically activity: birds prints,1-2/10cm, no worms or snails
composition: mud, scant sand + debris
other features: cold, windy and sunny

**Surface sample:** (from top 5mm) - 7A2

| | | |
|---|---|---|
| Water content: | 220 | % of dry weight |
| Bulk density: | 1251 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 9.08 | % by weight |
| Median size d50: | 4.39 | microns |
| Sand content: | 0.0 | % by weight |
| Silt content: | 76.0 | % by weight |
| Clay content: | 24.0 | % by weight |
| Mud Temperature: | 8.5 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 5.8
9.0
8.8
5.2
6.7
Average: 7.1

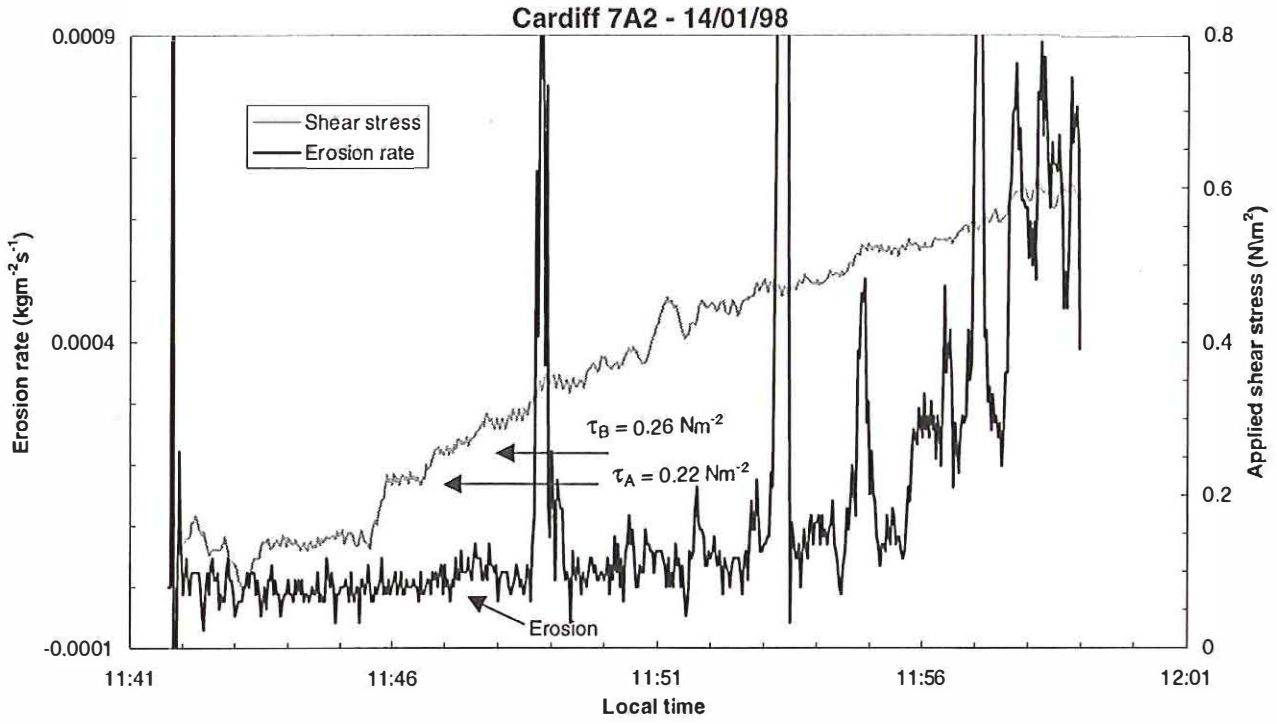
**Eroding Water:** (local collected at HW)
Salinity : 20

**Photographs:** Film: 1
Time: 11:33 Number: 3 before erosion

**Comments:** SedErode deployed on soft mud overlying Flandrian clay.

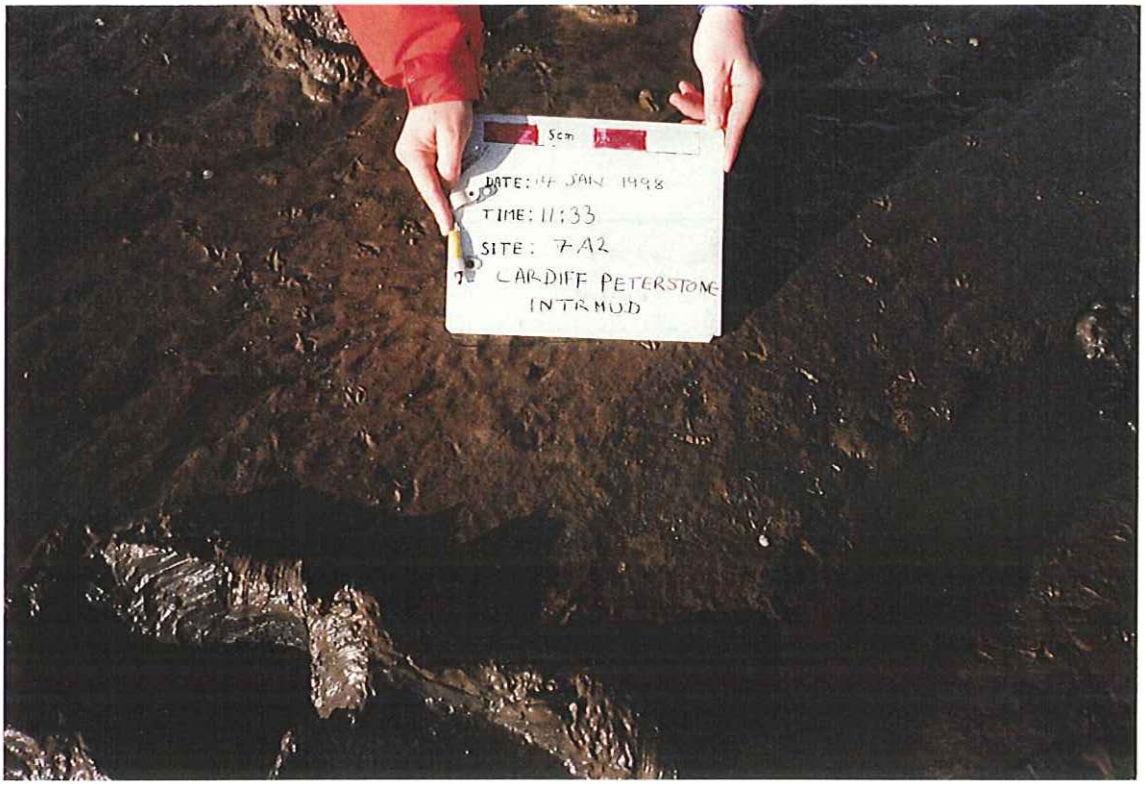
**Critical erosion shear stress between $\tau_a$ & $\tau_b$**

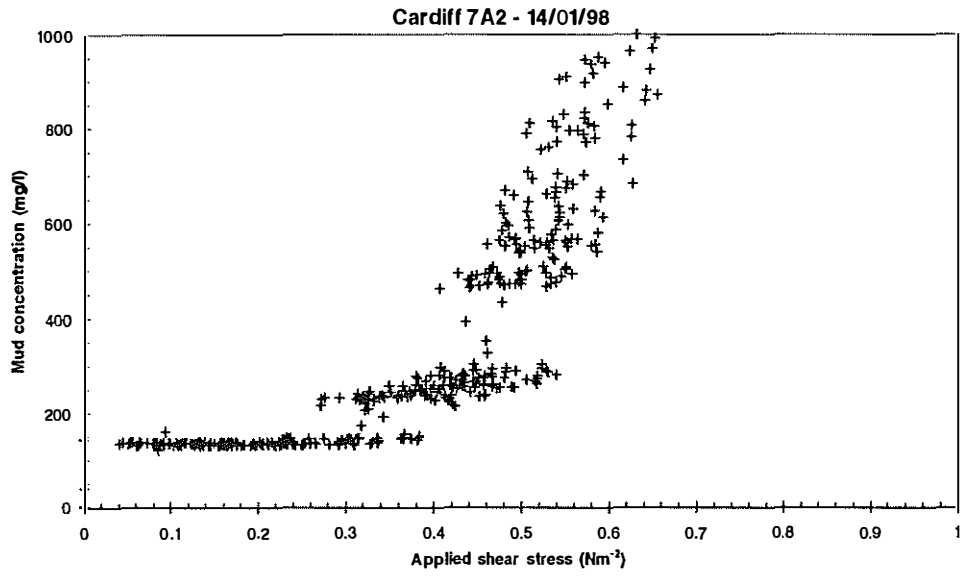
| | | |
|---|---|---|
| $\tau_a$ = | 0.22 | Nm$^{-2}$ |
| $\tau_b$ = | 0.26 | Nm$^{-2}$ |
| Average = | 0.24 | Nm$^{-2}$ |

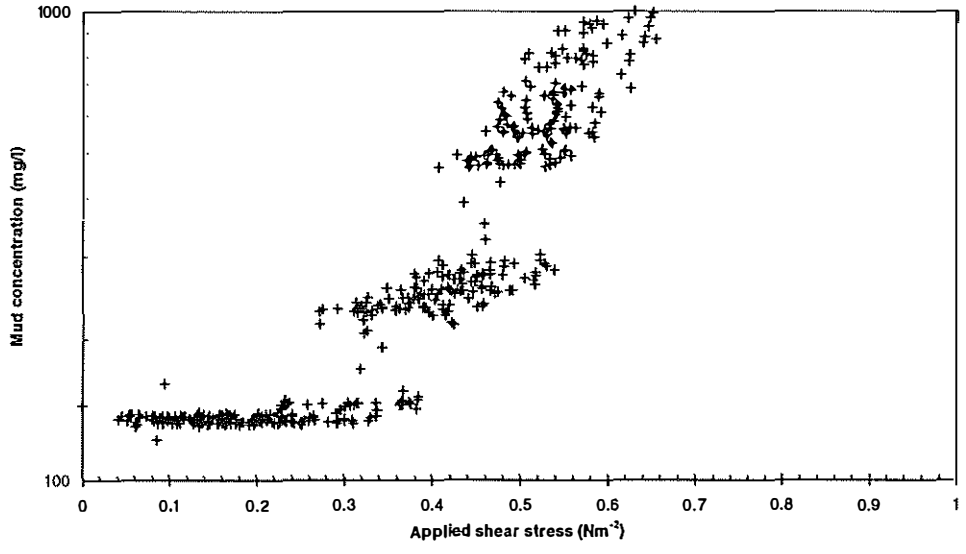


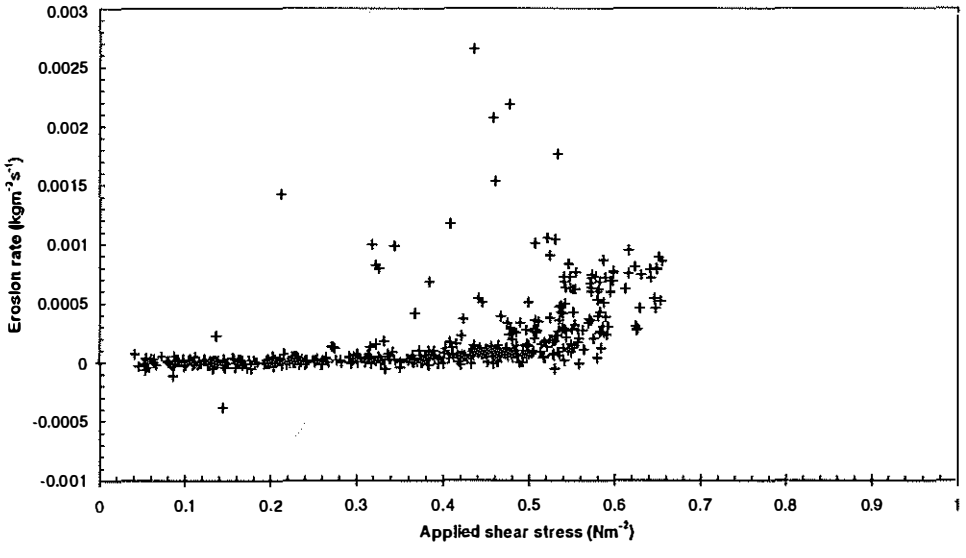

**Site:** **Cardiff winter survey January 98**
Time: 11:37
Date: 14/01/98
Operator: H.J.Mitchener

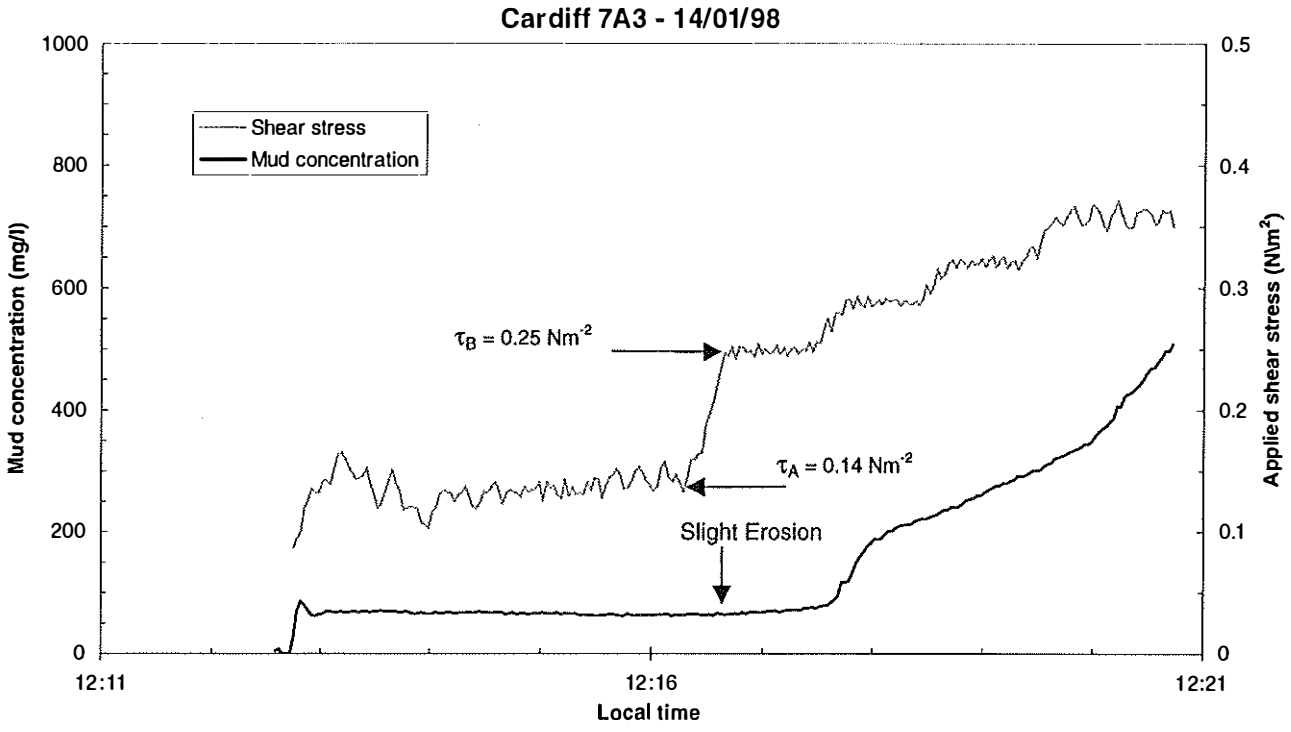
**Photographs:** Film: 1
Time: 11:33 Number: 3




Cardiff 7A2 - 14/01/98
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
-0.0005
-0.001
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff winter survey January** 98
Time: 12:02
Date: 14/01/98
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\intrmud\cardiff\cjan\cjan003

**Site description:**

texture: Medium soft, homogenous gritty
colour: brown, black flecks, green hue
covering: debris, water
topography: +/- 2mm, undulating
biologically activity: birds prints 1-2/10cm
composition: mud, scant sand
other features: cold, windy and sunny

**Surface sample:** (from top 5mm) - 7A3

| | | |
|---|---|---|
| Water content: | 223 | % of dry weight |
| Bulk density: | 1248 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 10.05 | % by weight |
| Median size d50: | 4.65 | microns |
| Sand content: | 0 | % by weight |
| Silt content: | 79 | % by weight |
| Clay content: | 21 | % by weight |
| Mud Temperature: | 8 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 7.6, 9.5, 8.2, 7.0, 8.5
Average: 8.2

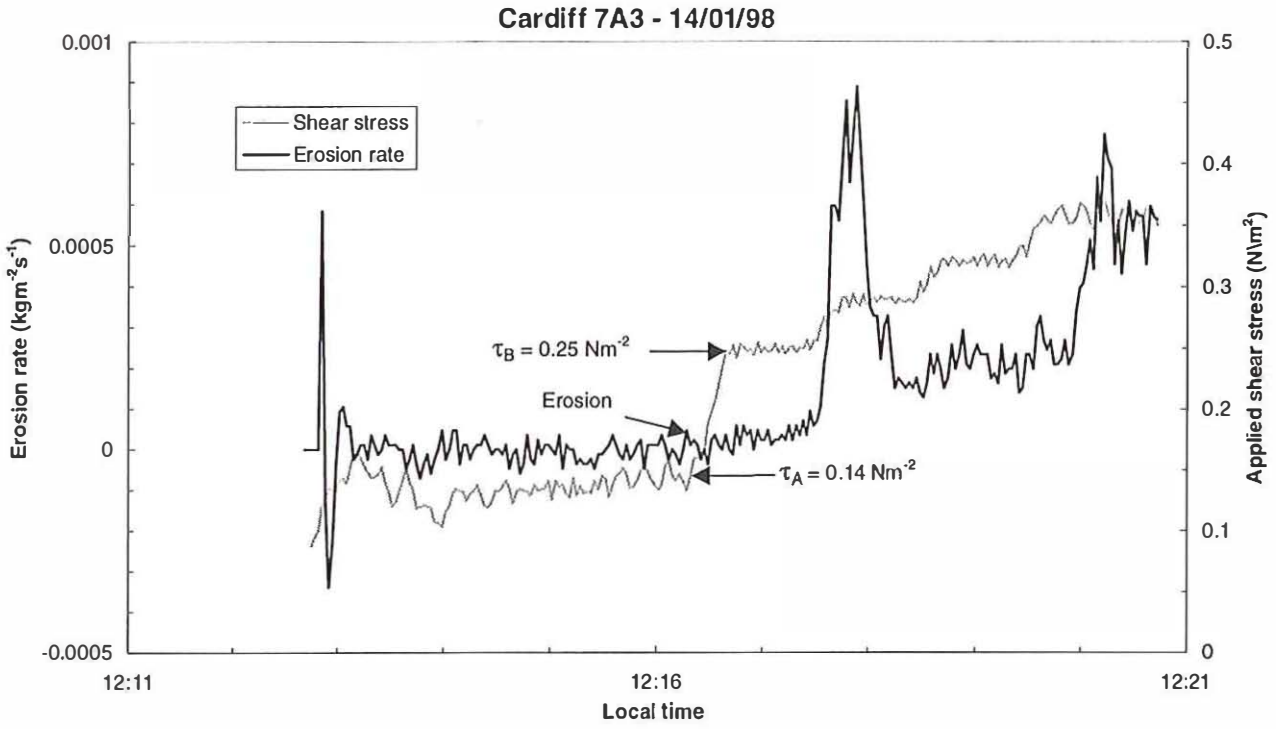
**Eroding Water:** (local collected at HW)
Salinity : 20

**Photographs:**
Time: Film: 1
Number: 7 before erosion

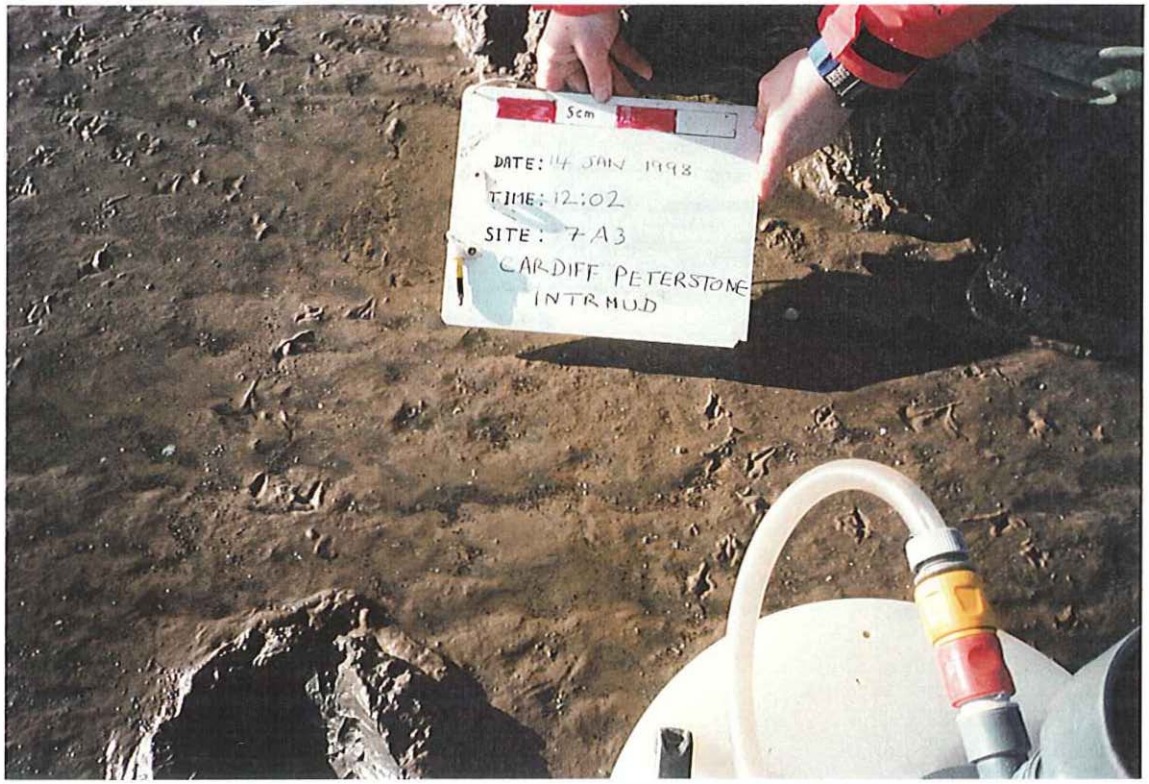
**Comments:** SedErode was deployed on soft mud overlying Flandrian clay.

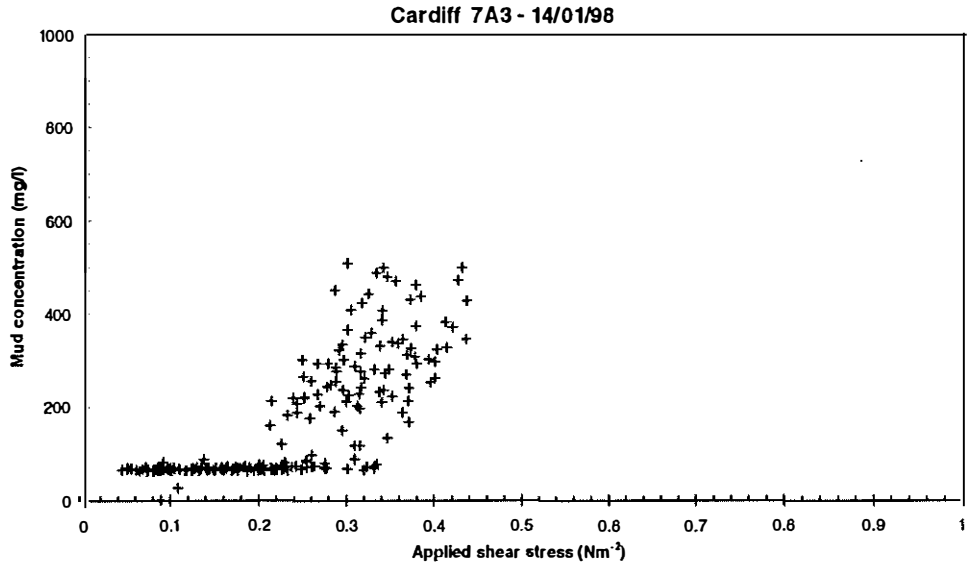
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

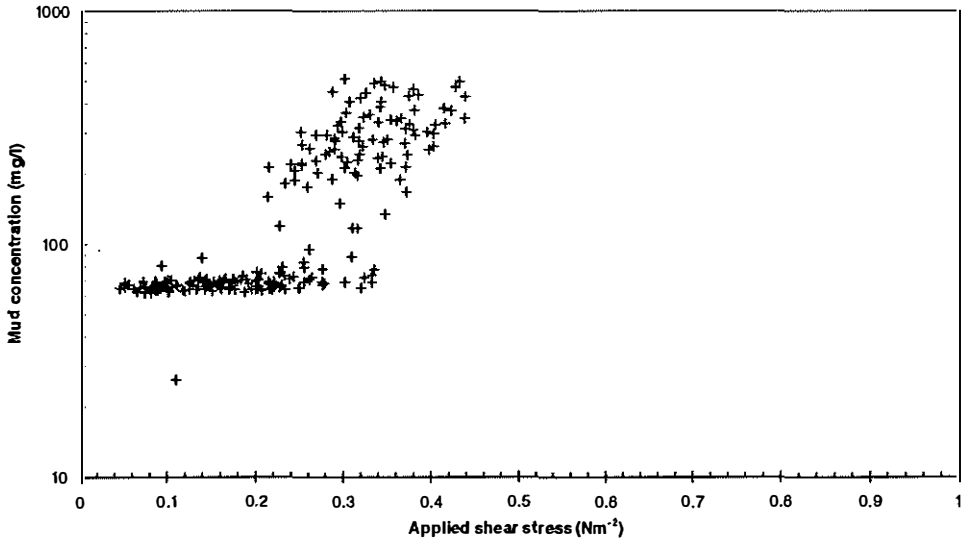
| | | |
|---|---|---|
| $\tau_A$ = | **0.14** | **$Nm^{-2}$** |
| $\tau_B$ = | **0.25** | **$Nm^{-2}$** |
| **Average =** | **0.20** | **$Nm^{-2}$** |

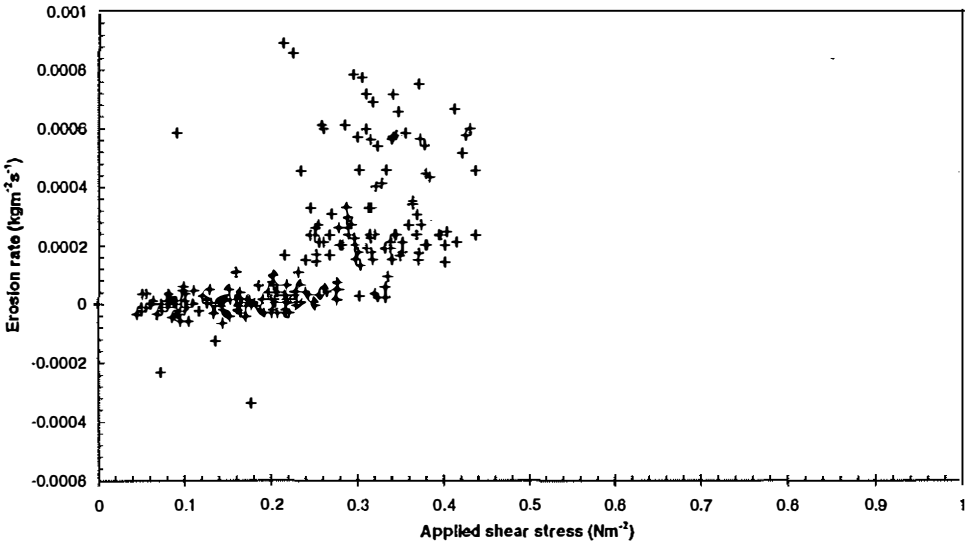


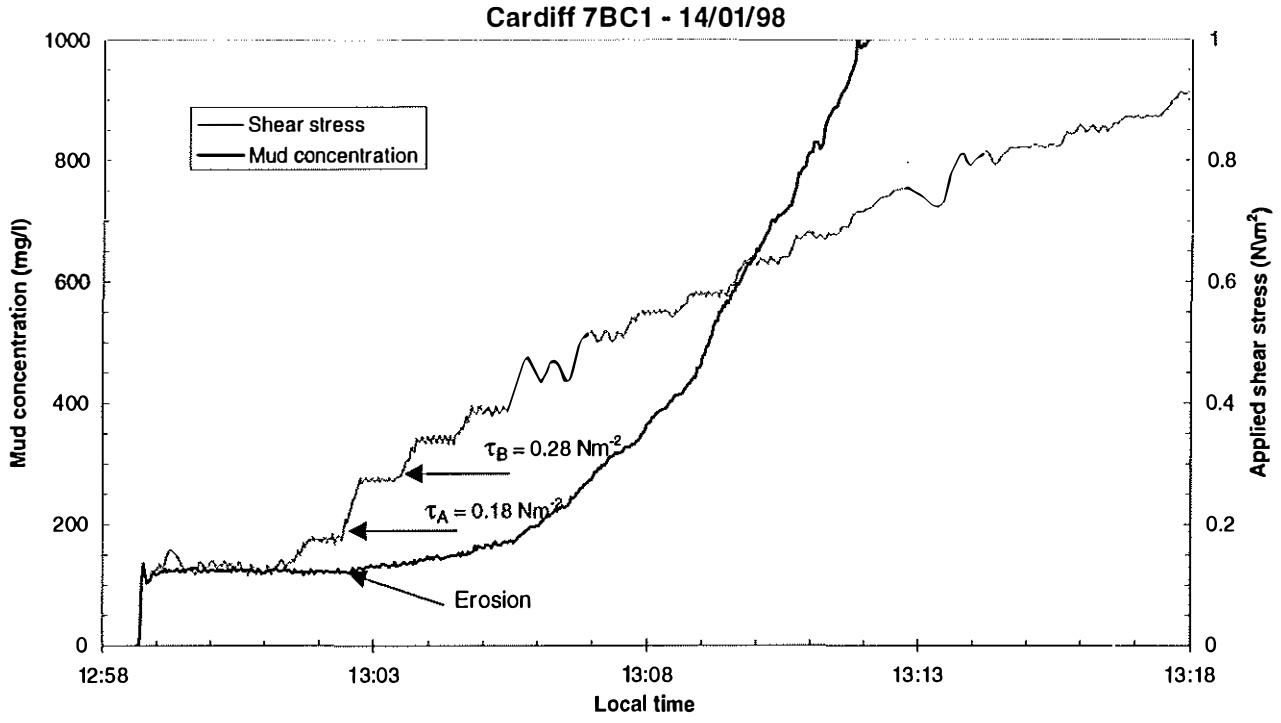

| | | | | |
|---|---|---|---|---|
| **Site:** | **Cardiff winter survey January 98** | **Photographs:** | Film: | 1 |
| Time: | 12:02 | Time: | Number: | 7 |
| Date: | 14/01/98 | | | |
| Operator: | H.J.Mitchener | | | |




Cardiff 7A3 - 14/01/98
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.001
0.0008
0.0006
0.0004
0.0002
0
-0.0002
-0.0004
-0.0006
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Applied shear stress (Nm-2)




**Site:** **Cardiff winter survey January 98**
Time: 12:52
Date: 14/01/98
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjan\cjan004

**Site description:**
texture: Flandrian clay- hard
colour: blue grey- scant brown soft mud on top
covering: scant mud, some sand/shell deposits
topography: +/- 2mm pitted
biologically activity: pitted 5-10/10 cm
composition: clay scant sand
other features: less windy, cold, sunny

**Surface sample:** (from top 5mm) - 7BC1

| | | |
|---|---|---|
| Water content: | 100 | % of dry weight |
| Bulk density: | 1448 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 6.69 | % by weight |
| Median size d50: | 4.95 | microns |
| Sand content: | 0.0 | % by weight |
| Silt content: | 75.0 | % by weight |
| Clay content: | 25.0 | % by weight |
| Mud Temperature: | 9 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 15.8
16.6
16.3
12.9
15.8
Average: 15.5

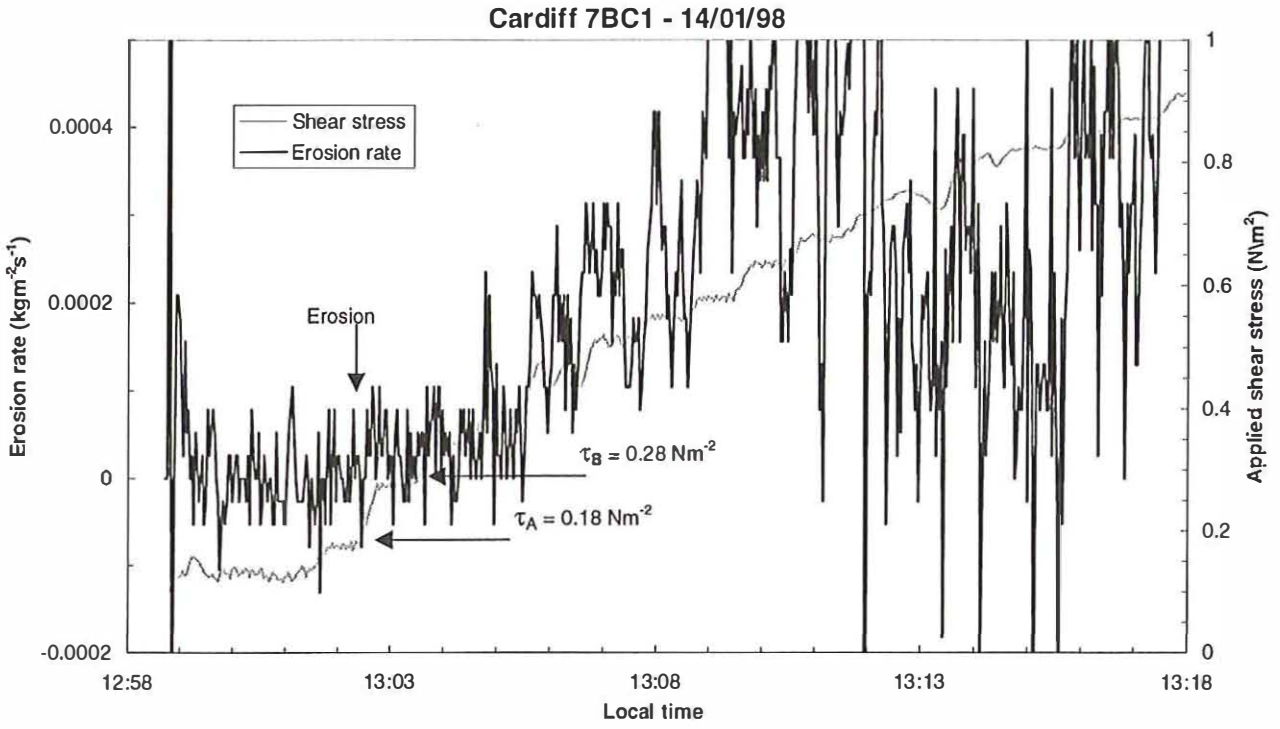
**Eroding Water:** (local collected at HW)
Salinity : 20

**Photographs:** Film: 1
Time: 12:50 Number: 8 before erosion

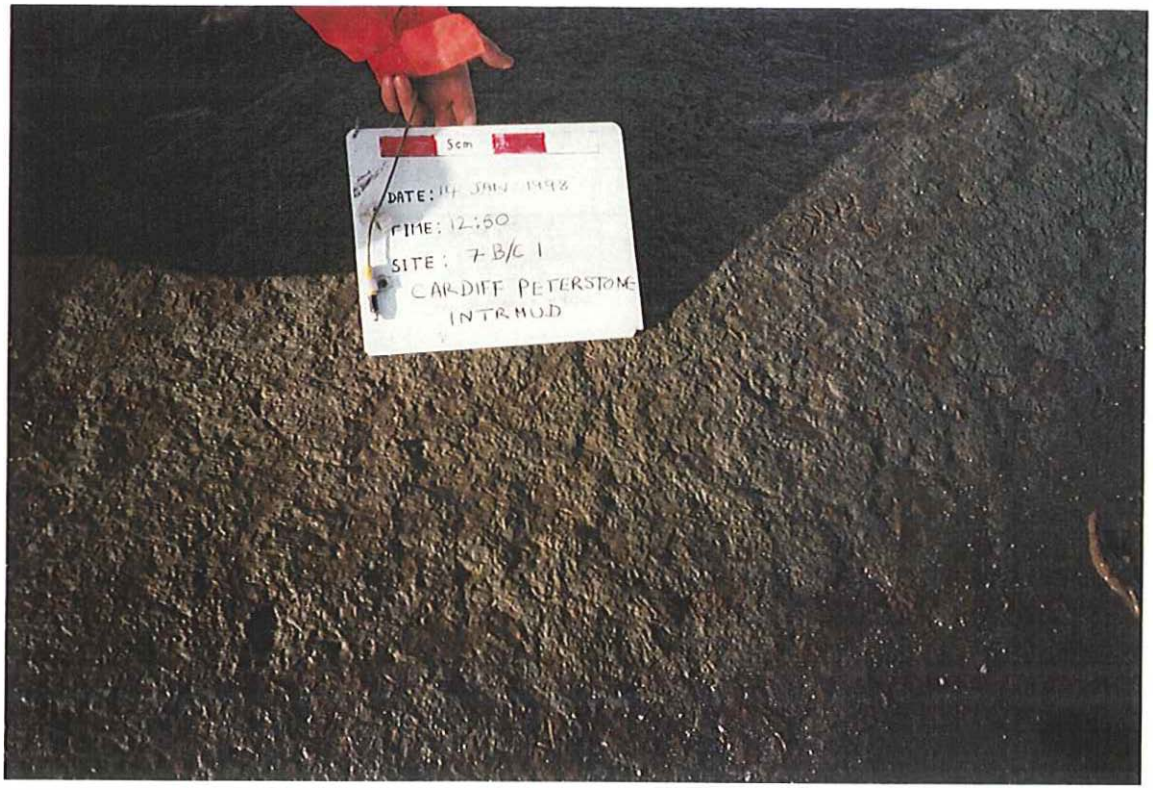
**Comments:** Flandrian clay exposed between sites B and C. Still erodes slowly with SedErode

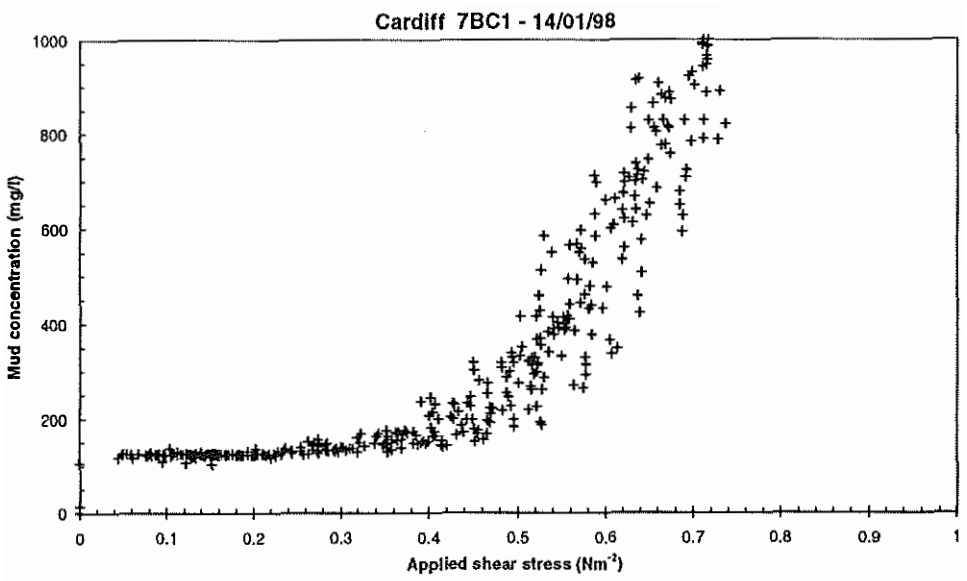
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

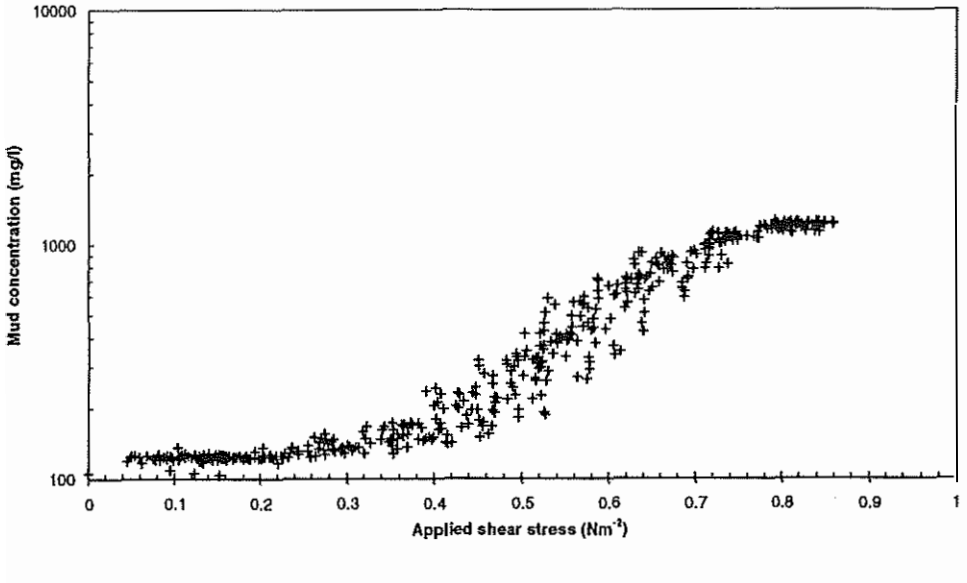
| | | |
|---|---|---|
| $\tau_A$ = | 0.18 | Nm$^{-2}$ |
| $\tau_B$ = | 0.28 | Nm$^{-2}$ |
| Average = | 0.23 | Nm$^{-2}$ |

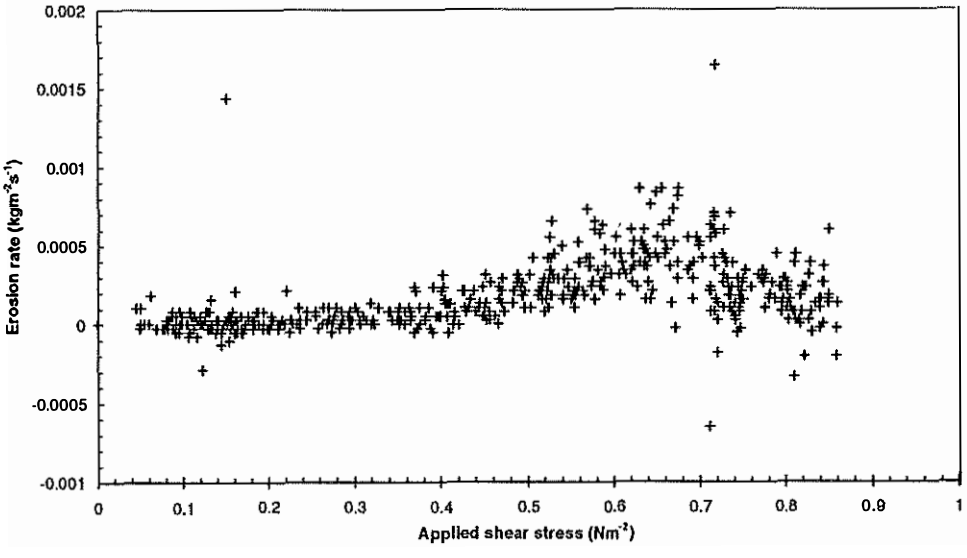


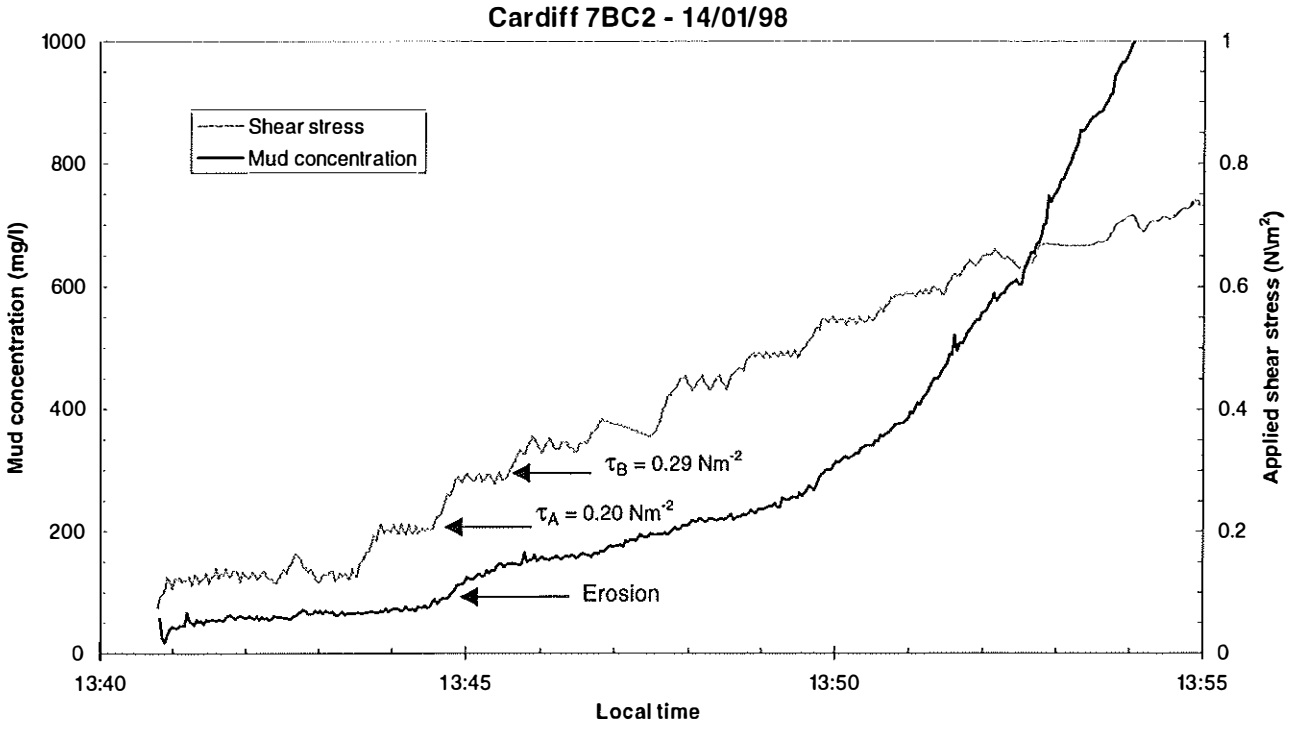

| | | | | | |
|---|---|---|---|---|---|
| **Site:** | **Cardiff winter survey January 98** | **Photographs:** | | Film: | 1 |
| Time: | 12:52 | Time: | 12:50 | Number: | 8 before erosion |
| Date: | 14/01/98 | | | | |
| Operator: | H.J.Mitchener | | | | |




Cardiff 7BC1 - 14/01/98
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
10000
1000
100
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.002
0.0015
0.001
0.0005
0
-0.0005
-0.001
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff winter survey January 98**
Time: 13:34
Date: 14/01/98
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjan\cjanoo5

**Site description:**
texture: very hard, homogenous
colour: blue, grey, flandrian clay
covering: none
topography: pitted +/- 2mm, 5-10 cm/10 diameter
biologically activity: none visible
composition: Flandrian clay
other features: less windy, cold, sunny

**Surface sample:** (from top 5mm) - 7BC2

| | | |
|---|---|---|
| Water content: | 86 | % of dry weight |
| Bulk density: | 1497 | $kgm^{-3}$ |
| Carbon (loss on ignition): | 6.90 | % by weight |
| Median size d50: | 5.05 | microns |
| Sand content: | 0 | % by weight |
| Silt content: | 74 | % by weight |
| Clay content: | 26 | % by weight |
| Mud Temperature: | 8 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 16.1
19.5
14.2
20.9
25.0
Average: 19.1

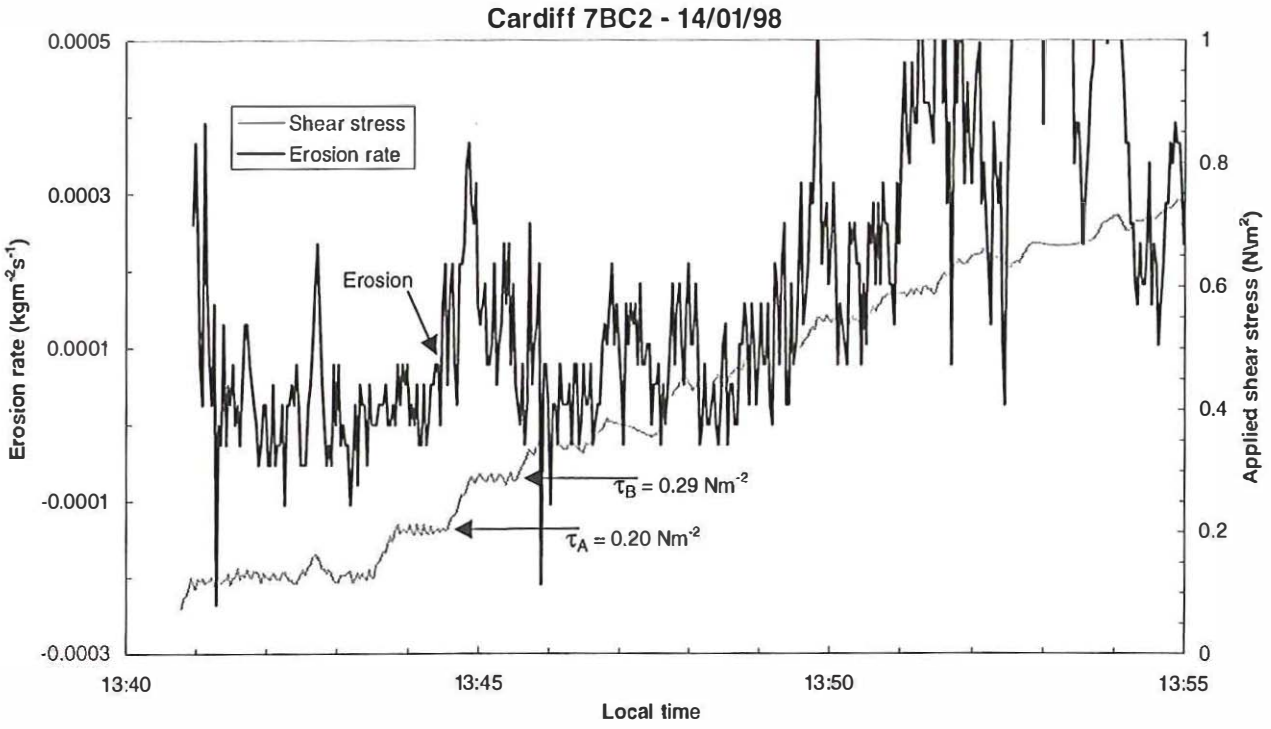
**Eroding Water:** (local collected at HW)
Salinity : 20

**Photographs:** Film: 1
Time: 13:33 Number: 9 before erosion

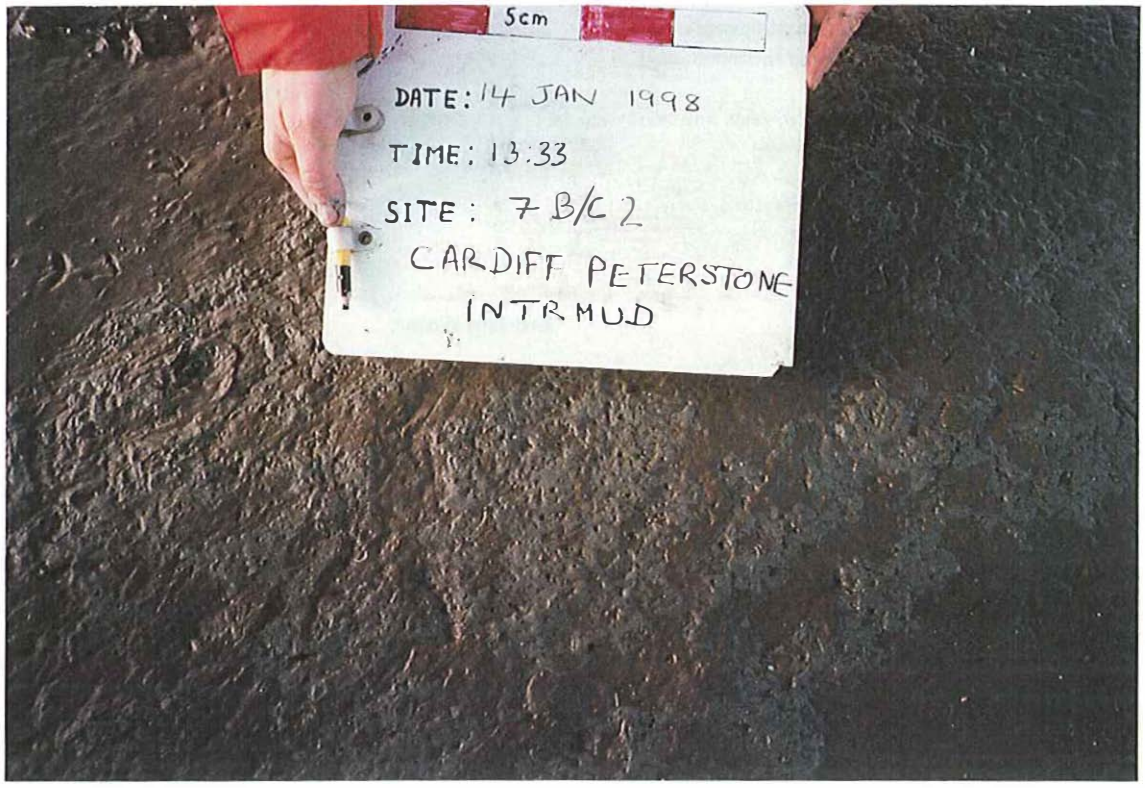
**Comments:** Flandrian clay exposed between sites B and C. Still erodes slowly with SedErode

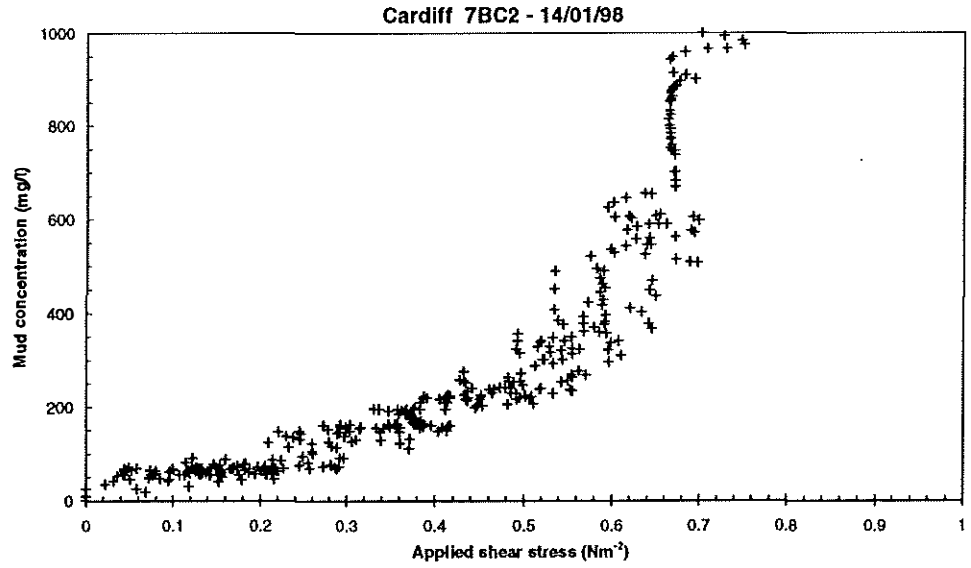
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

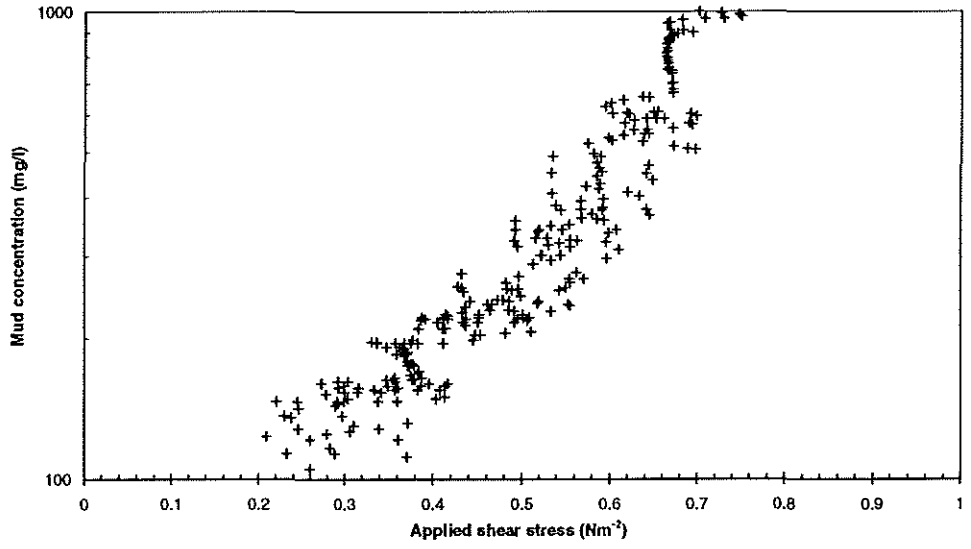
| | | |
|---|---|---|
| **$\tau_A$ =** | **0.20** | **$Nm^{-2}$** |
| **$\tau_B$ =** | **0.29** | **$Nm^{-2}$** |
| **Average =** | **0.24** | **$Nm^{-2}$** |

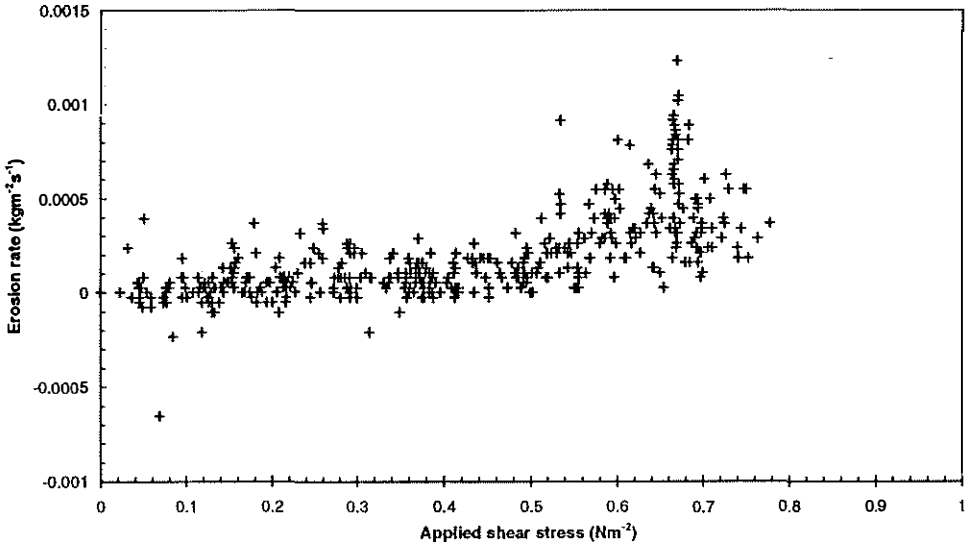


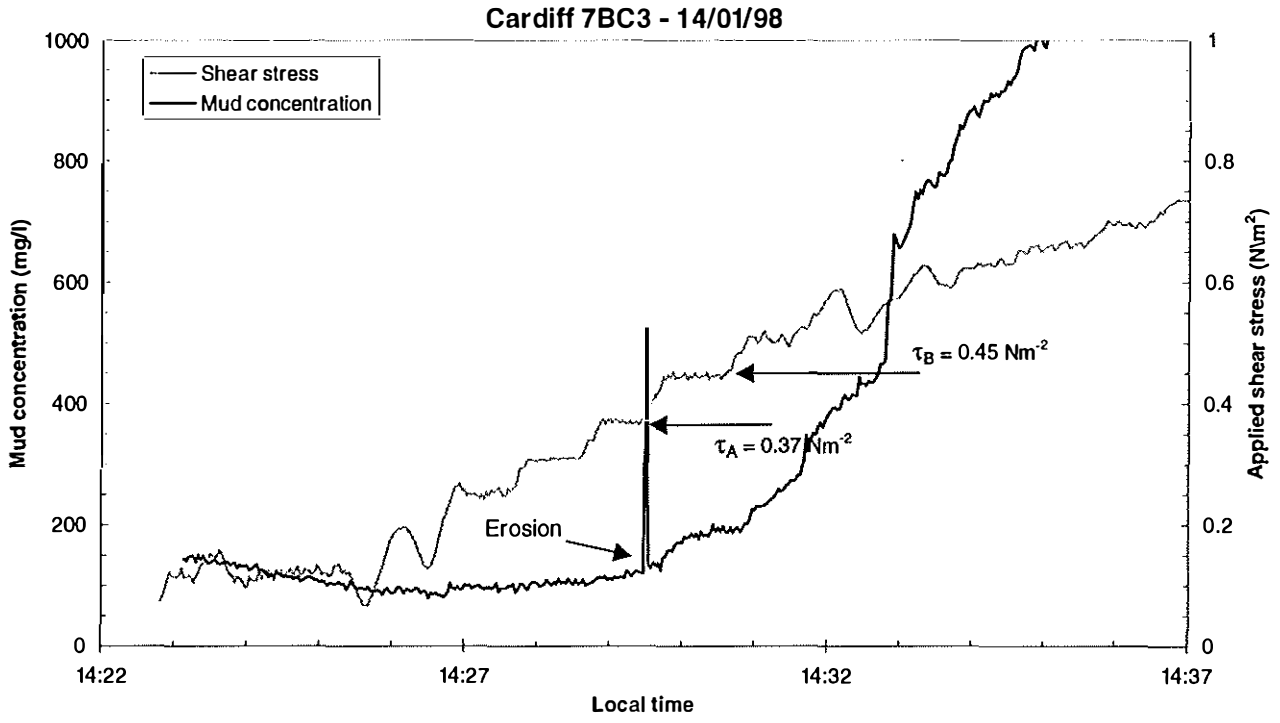

| | | | | | |
|---|---|---|---|---|---|
| **Site:** | **Cardiff winter survey January 98** | **Photographs:** | | Film: | 1 | |
| Time: | 13:34 | Time: | 13:33 | Number: | 9 | before erosion |
| Date: | 14/01/98 | | | | | |
| Operator: | H.J.Mitchener | | | | | |




Cardiff 7BC2 - 14/01/98
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.0015
0.001
0.0005
0
-0.0005
-0.001
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)




**Site:** **Cardiff winter survey January 98**
Time: 14:19
Date: 14/01/98
Operator: H.J.Mitchener

**Data file:** (downloaded from Squirrel data logger)
Path: ..\sediments\helen\intrmud\cardiff\cjan\cjanoo6

**Site description:**
texture: very hard, homogenous
colour: grey, blue, Flandrian clay
covering: some mud in places- planted on exposed clay
topography: +/- 2mm
biologically activity: pitted, no worms or hydrobia
composition: clay, scant sand
other features: cold, no sun, not as windy

**Surface sample:** (from top 5mm) - 7BC3

| | | |
|---|---|---|
| Water content: | 63 | % of dry weight |
| Bulk density: | 1602 | kgm$^{-3}$ |
| Carbon (loss on ignition): | 6.35 | % by weight |
| Median size d50: | 4.44 | microns |
| Sand content: | 0.0 | % by weight |
| Silt content: | 72.0 | % by weight |
| Clay content: | 28.0 | % by weight |
| Mud Temperature: | 8 | °C |

**Shear vane:** 33mm vane
Observer: Damon O'Brien
Measurements (kPa): 15.2
13.1
15.9
20.1
15.2
Average: 15.9

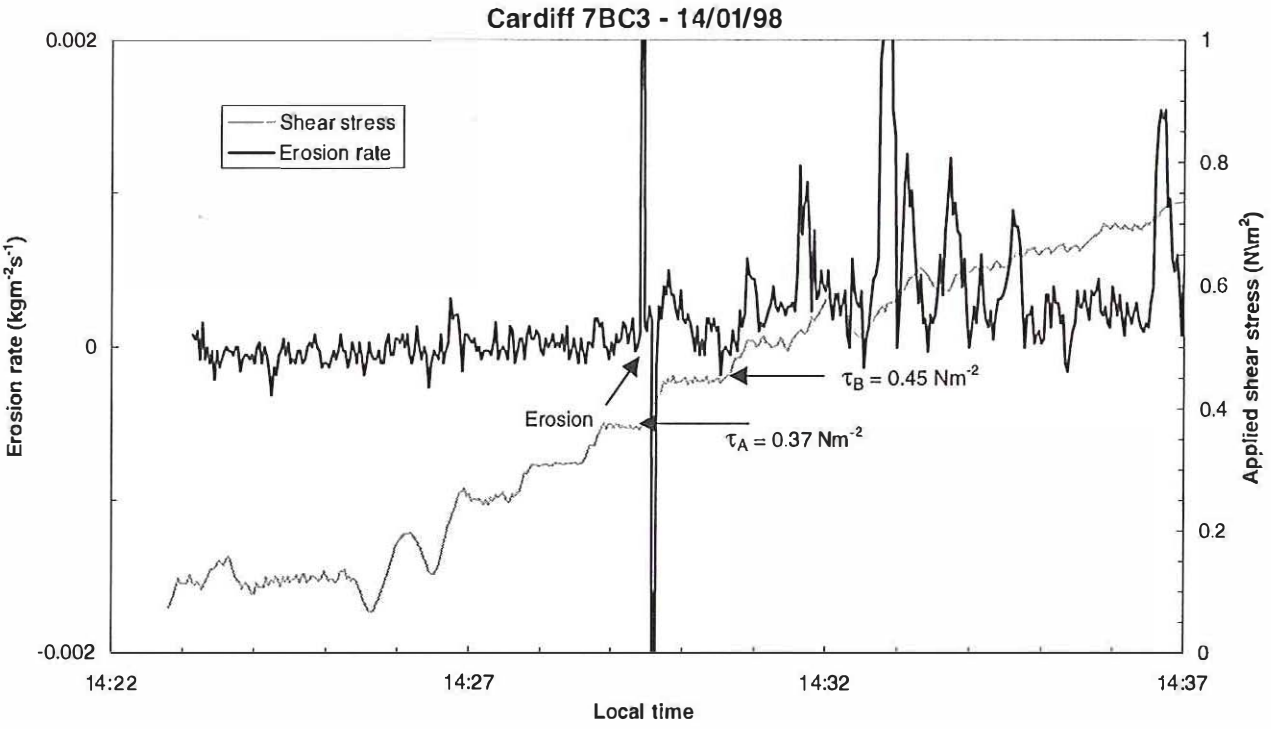
**Eroding Water:** (local collected at HW)
Salinity : 20

**Photographs:** Film: 1
Time: 14:09 Number: 10 before erosion

**Comments:** Flandrian clay exposed between sites B and C.

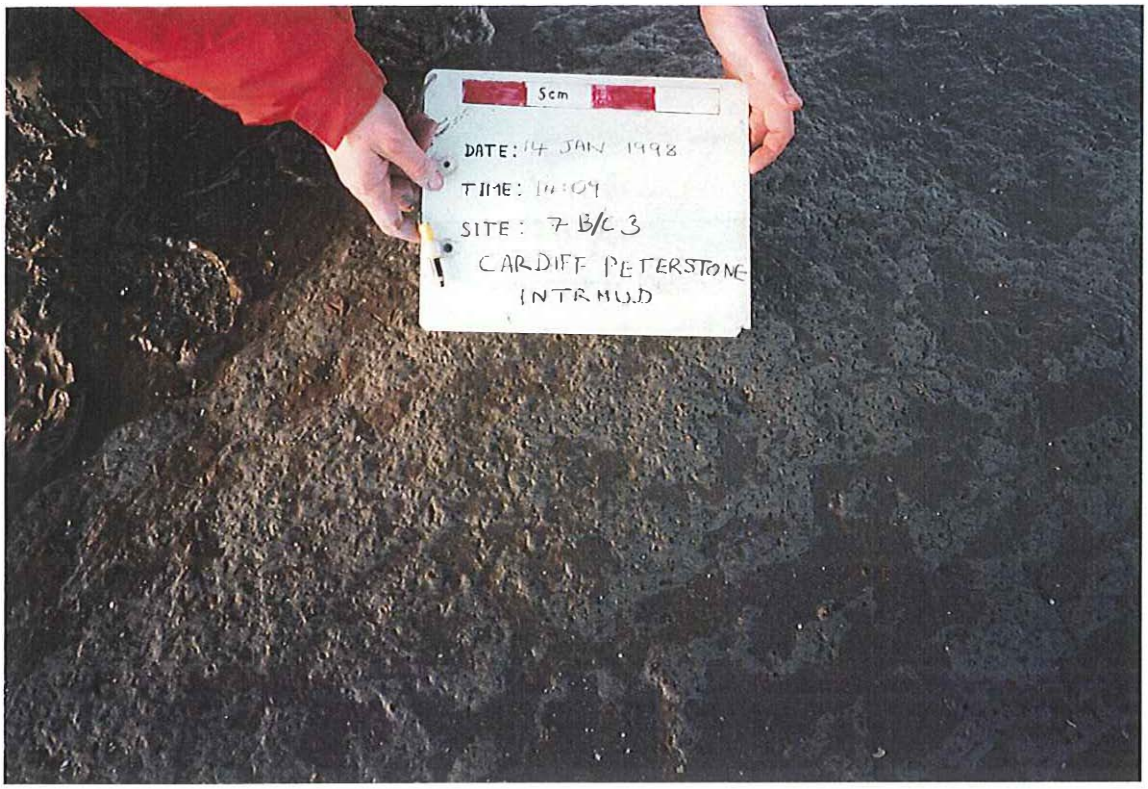
**Critical erosion shear stress between $\tau_A$ & $\tau_B$**

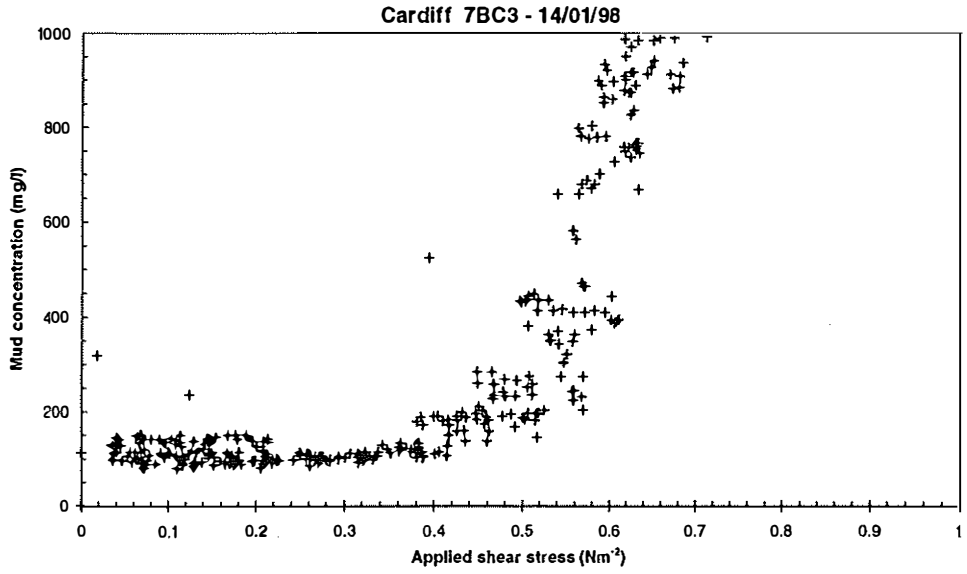
| | | |
|---|---|---|
| $\tau_A$ = | 0.37 | Nm$^{-2}$ |
| $\tau_B$ = | 0.45 | Nm$^{-2}$ |
| Average = | 0.41 | Nm$^{-2}$ |

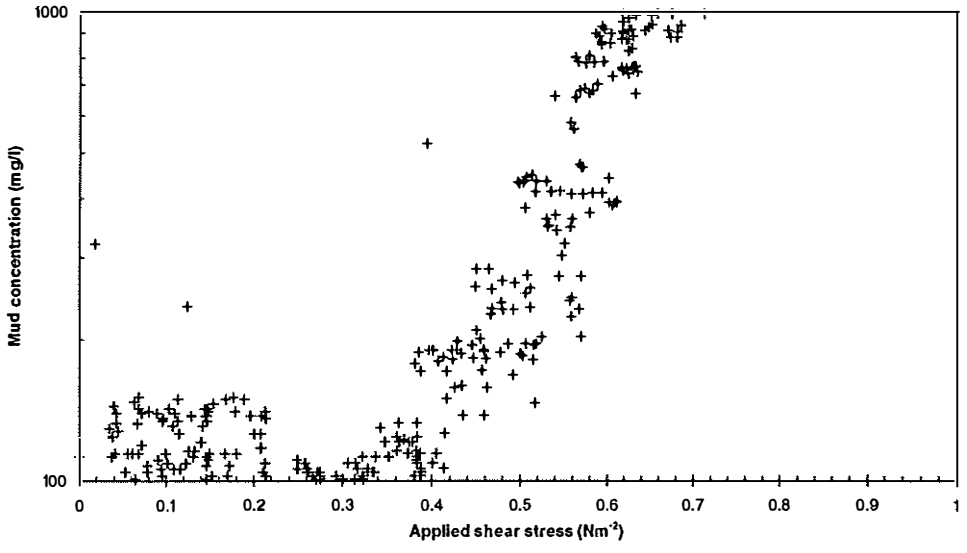


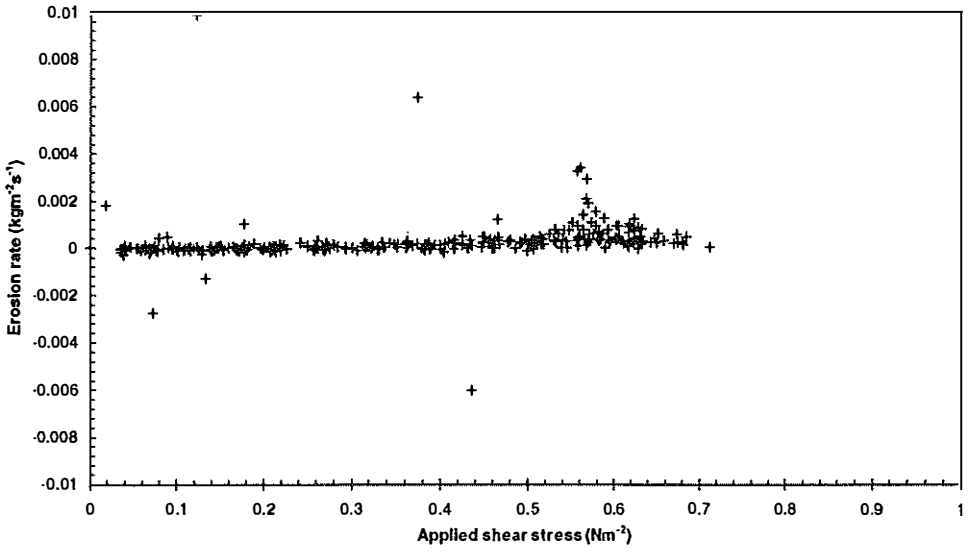

**Site:** **Cardiff winter survey January 98**
Time: 14:19
Date: 14/01/98
Operator: H.J.Mitchener

**Photographs:** Film: 1
Time: 14:09 Number: 10 before erosion




Cardiff 7BC3 - 14/01/98
Mud concentration (mg/l)
1000
800
600
400
200
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Mud concentration (mg/l)
1000
100
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)


Erosion rate (kgm-2s-1)
0.01
0.008
0.006
0.004
0.002
0
-0.002
-0.004
-0.006
-0.008
-0.01
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Applied shear stress (Nm-2)