content (18.1 percent) of the cellular fraction are as low as those of the Herrin coal but lower than the hydrogen and oxygen contents of cellulose, the cypress log, and lignin. Even though the hydrogen content of the lignitic log is similar to that of the fine cellular fraction from the medullosan stem, the lower carbon content (70.0 percent) and higher oxygen content (28.3 percent) of the log clearly indicate that it is not as coalified. The elemental composition of the coal ball fraction indicates that the stem has approximately the same rank as a high volatile C bituminous coal, or the same rank as the Herrin coal from the area where the coal ball was collected (*11*).

All the data on the coal ball stem indicate that the organic matter is coalified to a rank equivalent or nearly equivalent to that of coal outside the coal ball. This leads us to an important point concerning the effect of compactional pressure in coalification. In coal balls the organic matter was entombed at an early peat stage and generally is uncompressed (*1*). Furthermore, once entombed, such coal ball peat was protected from the effects of pressure; the surrounding peat underwent compaction in a manner characteristic of normal coalification. Thus this study suggests that compaction has little, if any, effect on the chemical processes involved in coalification of medullosan plant tissues up to the rank of high volatile C bituminous coal.

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Remote Acoustic Detection of a Turbidity Current Surge

Abstract. *A turbidity current surge has been detected in a leveed submarine channel in Rupert Inlet, British Columbia, with the use of acoustic sounders operating at 42.5, 107, and 200 kilohertz.*

It is generally believed that turbidity currents have been responsible for the formation of submarine canyons and their associated deep-sea fans and fan channels (*1*). Yet there have been very few real-time observations of turbidity current surges, and this has led Normark (*2*), among others, to point out the absence of empirical constraints on the existing theory. We report the detection of a surge-type turbidity current in water depths of 130 to 140 m, using acoustic sounders operating at 42.5, 107, and 200 kHz with transducers mounted in the hull of a surface vessel. The event was detected during a thesis study by one of us (A.E.H.) of turbidity currents and submarine channels resulting from the discharge of mine tailing into Rupert Inlet, British Columbia. To our knowledge, the results presented here are the first of their kind.

The bathymetry in Rupert Inlet in November 1976 is shown in Fig. 1. The leveed submarine channel is evident and is shown extending from the point of discharge (outfall) across- and then down-inlet. The channel exhibits in sequence a left-hooking upper reach, a meandering middle reach, and a relatively straight lower reach, as the axial slope decreases with increasing distance from the outfall. Also shown in Fig. 1 is the echo-sounding transect (line *T–T′*) corresponding to the acoustic records in Fig. 2. These records were obtained with a 200-kHz Ross Laboratories model 200 fine-line recorder on the Canadian Survey Ship *Vector* on 26 August 1976 during four successive repetitions of the transect in opposite directions. The first and second transects were part of a bathymetric survey. Repeated crossings were made after the event was detected.

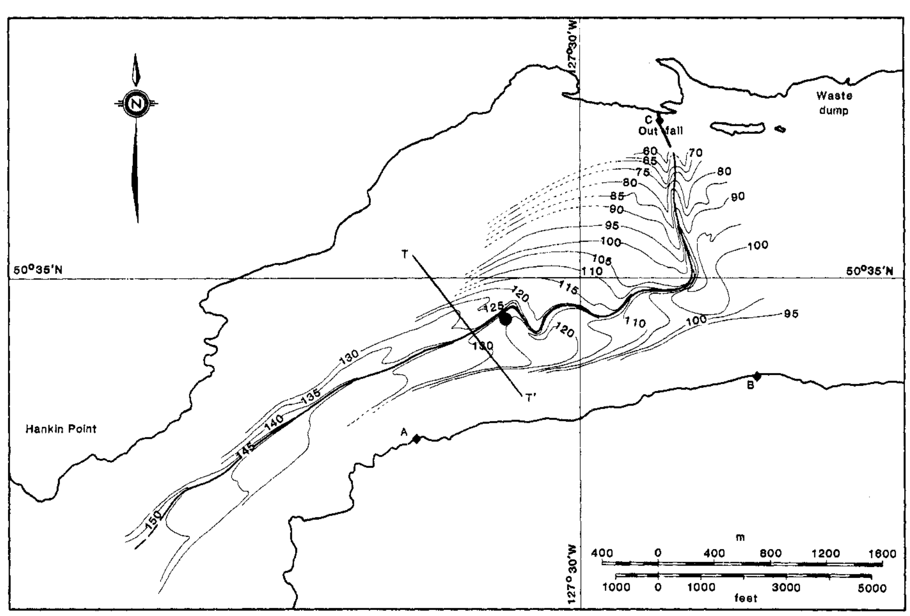

Fig. 1. Rupert Inlet bathymetry in November 1976. Contours are in meters. The circle indicates the approximate location of the August 1976 current meter mooring, and the line *T–T′* marks the position of the sounding transect corresponding to the records in Figs. 2 and 3; *A*, *B*, and *C* denote the locations of microwave positioning transponders.

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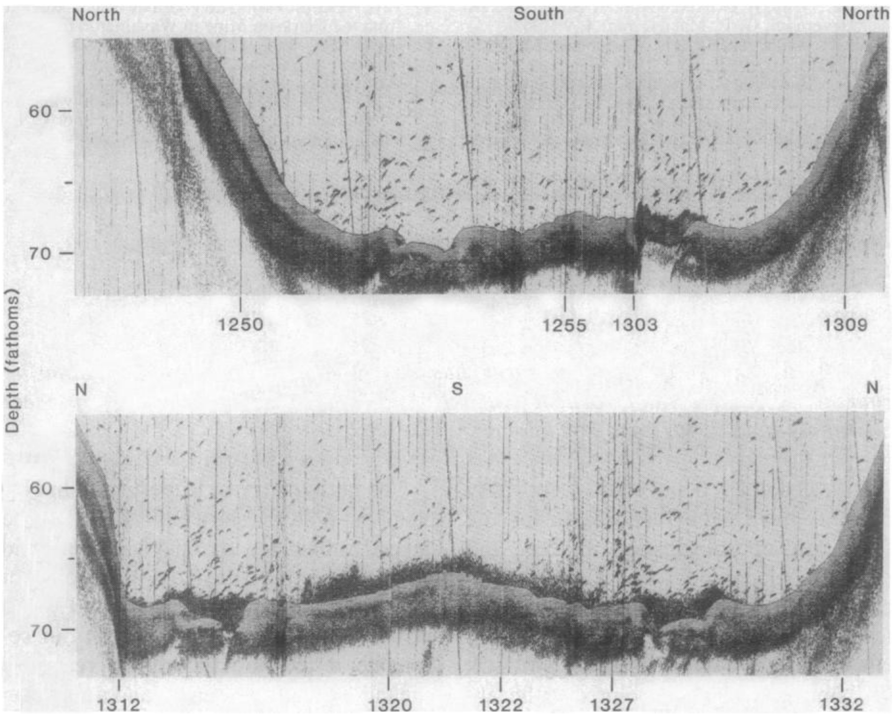
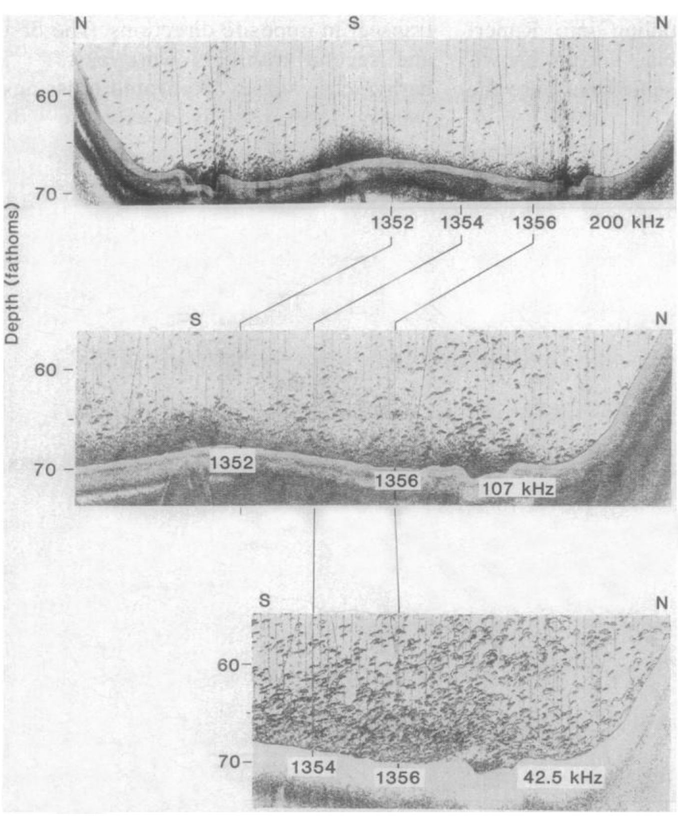


Fig. 2. Four acoustic sounding profiles at 200 kHz in succession back and forth along the transect *T–T'* in Fig. 1. The turbidity current first appears in the second profile and is present in the third and fourth. The times indicated are Pacific daylight time. The inclined, straight lines are due to the transmitted pulse from another sounder.

The records show the acoustic backscatter over a depth interval of 50 to 75 fathoms (about 92 to 137 m). The duration of the transmitted pulse was 0.1 msec. The bottom echo is the upper edge of the uniform gray band. Discrete scatterers, presumably fish, are present in the water column above the bottom. The leveed submarine channel appears in cross section in each profile at the base of the north slope.

The difference in the acoustic signature of the channel between the first and second profiles is due to the presence of a channelized turbidity current surge in the second profile. The increased backscatter from the surge itself is accompanied by severe attenuation of the bottom echo. Both the reverberation from the surge and the bottom-echo attenuation decrease in the third and fourth profiles. Channel overspill is evident in the second profile and to increasing degrees in the third and fourth. The discontinuity in the level of near-bottom backscatter to the south of the channel in the third profile suggests that the backscatter at the southern end of this profile is due to material spilling over the levees in the meander reach upstream. Later profiles (not shown) indicate a continuous decrease in the backscatter amplitude with time both within and beyond the channel until the event was no longer detectable about 1.5 hours after its onset.



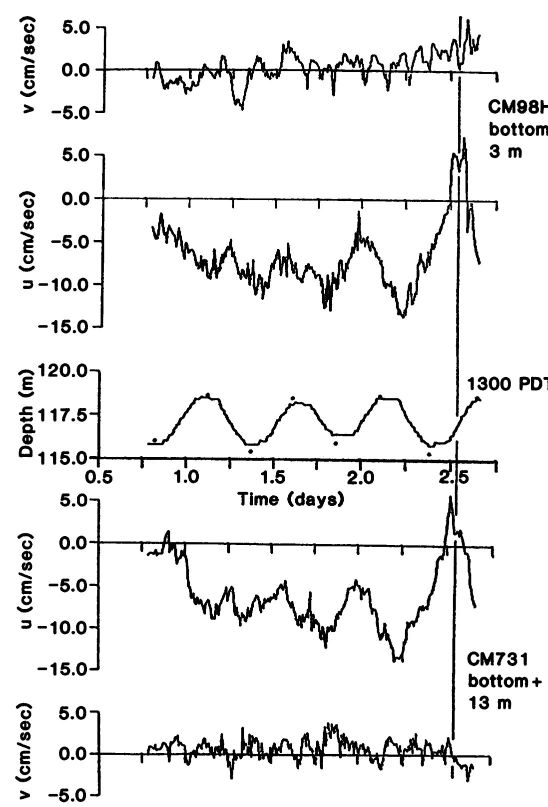


Fig. 3 (left). Acoustic sounding profiles at 200, 107, and 42.5 kHz. Times are Pacific daylight time. The distortion of the 200-kHz record is due to mechanical problems with the chart paper drive. Fig. 4 (right). Current records from the two meters at the approximate mooring location indicated in Fig. 1. The up-inlet (u) and cross-inlet (v) components are plotted together with the recorded pressure (converted to depth) and predicted tide (circles).

Figure 3 shows records taken simultaneously at 200, 107, and 42.5 kHz. The pulse lengths and beam widths at each frequency were nominally identical (0.1 msec, 5° by 10°). Since the three transceiver systems were not intercalibrated, direct comparison of signal levels is not possible. However, discrete scatterers (fish?) in the water column common to the three frequencies provide a basis for qualitative comparison of the relative signal levels at the three frequencies. The relative amplitude of the reverberation from the turbidity current to that from discrete scatterers decreases with decreasing frequency in these records. Since the median diameters of samples of sediment deposited along the channel axis are about 0.05 mm and that of the tailing before discharge is 0.03 mm, the median diameter of the particles suspended within the surge must be of the same order. This and the apparent frequency dependence of the signal suggest that the reverberation is due to Rayleigh scattering from suspended particles. The Rayleigh scattering mechanism has been suggested elsewhere (*3*) to account for reverberation from suspended sediment in the ocean and has been confirmed in additional quantitative experiments in Rupert Inlet in 1978 and 1979 (*4*).

A single-point mooring with two Aanderaa current meters set at a 2-minute sampling interval and at distances above the bottom of 3 and 13 m was in place during the event. The mooring location shown in Fig. 1 is approximate only, as we were unable to determine its exact position relative to the channel after deployment. The current records (Fig. 4) indicate a tidal modulation of a mean down-inlet flow. Subsequent to the onset of the event, there is an increase in vertical shear with higher up-inlet speeds (6 cm/sec) at the near-bottom meter and lower up-inlet speeds (< 2 cm/sec) at the upper meter. This shift to higher up-inlet speeds in the near-bottom zone suggests that the mooring was outside the channel.

The primary importance of the acoustic records in Figs. 2 and 3 lies partly in the fact that they represent the realization of a method for the remote detection of a phenomenon which subjects in situ instrumentation to high risk of loss or damage and partly in the fact that quantitative estimates of flow thickness, suspended solids concentration, and surge speed (from acoustic sounders distributed along the surge path) can be obtained (*4*). Theoretically, the surge speed along a horizontal bottom depends only upon the surge thickness and excess density due to suspended solids (*5*). Acoustic remote sensing offers the opportunity to test the theory on sloping bottoms at scales orders of magnitude greater than those achievable in the laboratory.

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Phosphorylation of Myosin Light Chains in Mouse Fast-Twitch Muscle Associated with Reduced Actomyosin Turnover Rate

Abstract. *Phosphorylation of the 18,000-dalton light chains of the fast-twitch myosin in mouse extensor digitorum longus muscles was correlated with reduction in the rate of the actomyosin adenosinetriphosphatase in vivo, but neither of these changes occurred in the soleus muscle. These results suggest that actomyosin interactions can be down-regulated by a reversible covalent modification of myosin light chains, that a mechanism for thick-filament regulation occurs in vertebrate skeletal muscle, and that the expression of this regulation may be limited to a specific fiber type.*

Myosin molecules contain lower molecular weight subunits called light chains (*1–3*). A functional role for light chains has been shown clearly (i) in systems where the primary control of contraction is linked to the myosin thick filament, such as in scallop muscle (*2–4*), or (ii) in smooth muscle where the expression of the regulatory nature of these light chains is dependent on their phosphorylation (*5–7*). In skeletal muscle, where the primary control of contraction is exerted on the actin-containing thin filament (*8*), a regulatory role of myosin light chains has not been established, since removal of these light chains from the parent molecule has little effect on its adenosinetriphosphatase activity in vitro (*9*). Nevertheless, vertebrate skeletal muscles contain the enzymes capable of reversibly phosphorylating the 18,000-dalton light chains (*10–12*). The possibility exists, therefore, that the expression of the regulatory nature of skeletal muscle light chains is linked to their phosphorylation. Yet, despite reports that light chain phosphorylation decreases the apparent K_m (K_m, Michaelis constant) for actin-activated myosin adenosinetriphosphatase in vitro (*13*) and that it is associated with post-tetanic potentiation of the twitch in rat fast-twitch muscle (*14*), no unified functional role has been demonstrated for myosin light chain phosphorylation.

Our experiments on isolated mouse muscles suggest phosphorylation of 18,000-dalton light chains is an unusual thick filament–linked regulatory system in that the modulation is inhibitory. The functional significance of phosphorylation of vertebrate skeletal muscle myosin may be related to the apparent fiber-type specificity. Fast glycolytic fibers are optimum for large power outputs (*15*) because of their large cross-sectional area and of their organization into large motor units. Maximum power is needed only in situations of extreme acceleration and of large power output. Fast-twitch fibers have a higher energy cost for contraction than do slow-twitch fibers (*16*). However, great speed and mechanical power is not necessary or useful for sustained forceful contractions. Phosphorylation of the light chains in these fibers and the concomitant reduction in actomyosin turnover rate may therefore be a mechanism to reduce fatigability in sustained forceful contractions.

We have previously reported a decrease in the rate of energy utilization

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