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discussed in the previous section. Other maximum changes in the slope are due to normal thin layer, early to late time moveouts.

This simple analysis could have led Spies and Parker (1984) and Irvine and Staltari (1984) to recognise their responses as being due to variations in overburden and not from a conductor at depth.

The response over the Hellyer deposit in Tasmania shown in Figure 3 is dominated by a 'late' time $t^{2.7}$ power law decay and hence current gathering effects may be inferred. The reason that current gathering dominates is that in this cross section the dimension of the deposit is small in comparison to its depth. Therefore, at the surface, vortex flow effect is small compared to the magnetic field from unidirectional current gathering flow. This is not to say that the body is a poor conductor. The time constant obtained from down hole EM measurements is about 3-4 milliseconds (Eadie, 1987). In spite of the fact that current gathering was known to dominate this response, the conductor became a primary target because the visual estimate of the second derivative of the profile shows a smooth continuous variation not indicative of any obvious edge effects which may be related to a broad shallow formational conductor.

The response over the very large Red Dog deposit (Van Blaricom and O'Connor, 1986), is dominated by a current gathering effect, due to its bulk resistivity of 125 Ωm (Figure 4). Any attempt to explain these results in terms of a free space model fails. However the maximum changes in the profile slope uniquely correspond with the edges of the mineralization, with the smoother slope variation corresponding to deeper terminations. The response between edges 2 and 3 is not diagnostic of any particular source and interpreting it by conventional techniques would result in identification of a shallow conductor. However connecting edges 2 and 3, with the deeper edges

at 1 and 4, results in a unique interpretation of a substantial, mostly buried flat-lying target. As a comparison, the response marked by edge 5 is interpreted to be a very broad and outcropping source, and surface inspection downgraded it as a prospect.

Superficially, the current gathering response in Figure 5 is similar to the Hellyer anomaly. However, analysis of the very sudden changes in the slope of the profile identifies very shallow edges (less than 10 m from surface) from a broad conductive unit. In this area, this was not considered to be an orebody target.

A more complex profile (Figure 6) can be evaluated as a superposition of a number of responses, some of which show obvious near surface edge effects as sharp changes in the slope of the curve. Their locations have been confirmed by a conventional resistivity survey. These anomalous responses all have an approximate $t^{-5/2}$ 'late' time power law decay lasting until about 4 ms, and have no separation in time. However, since the objective on this property is to find a deeply buried deposit, the smooth continuous variation in the profile's slope, indicating a 'broad' second derivative gave evidence of a primary target. In this case the smooth part of the profile is outlining only a part of a normal cross-over type anomaly making quantitative interpretation difficult.

(b) Quantitative Approach

The problem posed in the quantitative approach is to remove or identify responses from sources which are not considered to be of economic importance, and to quantitatively interpret the second derivative.

As an example the profile data from Figure 6 is splined and the subsequently splined second derivatives is produced (Figure 7). This highlights the 'broad' non-zero second derivative and the near surface edge effects. Since, as discussed earlier, the halfwidth of the second
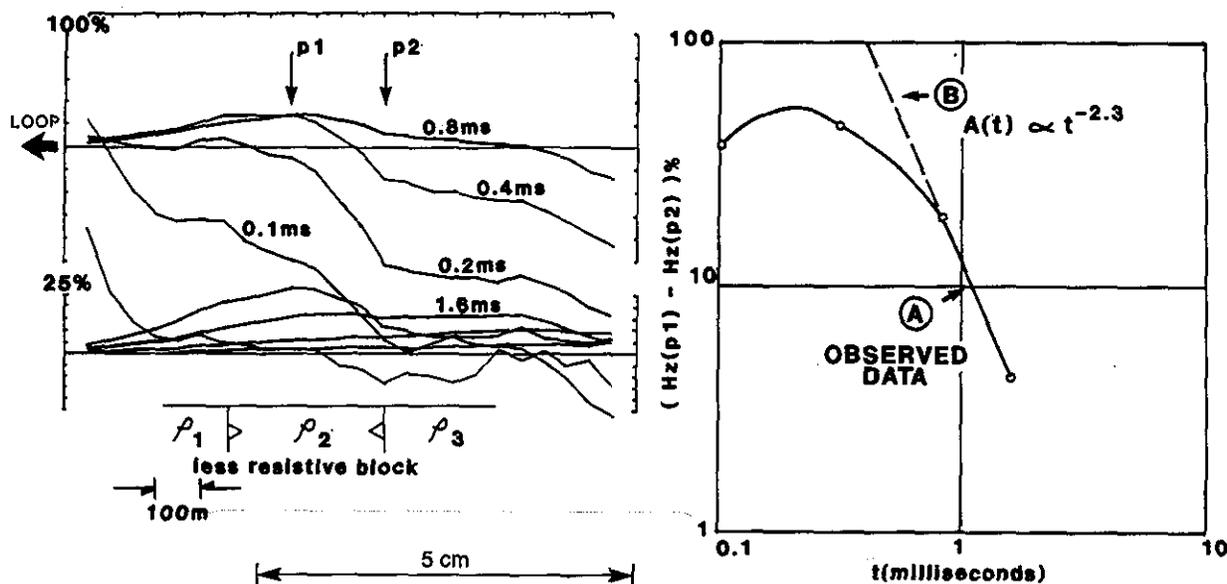

FIGURE 5
Current gathering response from a prospect near Marysville, B C, Canada shows superficial similarities to the Hellyer response in Figure 3. Sudden changes in slope identify this response to be from a broad near-surface source.