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independent of dip, and is a sum of two bell shaped functions which peak over the edges of the sheet with halfwidths 2h and $2h_L$.

Similarly it is shown that over a current sheet that is flat lying and has uniform current (eg. current gathering weathering trough), the second horizontal derivative of the vertical magnetic field peaks over the edges of a sheet with halfwidths equal to the depth to top of the sheet. The peak to peak distance in the vertical magnetic field however, is always greater than or equal to the width of the sheet. In cases where the width of the sheet is large in comparison to its depth to top, the peaks in the second derivative and the vertical magnetic field are in close proximity to each other. Similar conclusions apply for non-uniform current flow (Silic, 1989).

Figure 1 illustrates these important points. Some responses are superficially similar. For example the magnetic field over a vertical sheet at depth may approximate the vertical magnetic field over a wide sheet. However, the second derivative method will highlight the short halfwidths in the derivative over the 'shallow' edges of a flat lying sheet and allow the discrimination between the two responses as will the 'proximity' of the second derivative maxima with respect to the peaks in the vertical magnetic field. Over vertical conductors the peaks in the second derivative for Hz are at least a half depth unit closer to the cross-over point than the peaks in the magnetic field (Silic, 1989). By considering block conductors, similar conclusions apply; second derivatives peak over the edges of relatively steeply dipping blocks, with halfwidths equal to twice the depth to top. Also, in comparison with sheets, the inflection points of the vertical magnetic field are further out from the edges. Discrimination between block conductors, simulating broad lithological units, and relatively steeply dipping sheets then depends on the identification of block edges through the second derivative technique.

2: Analysis of Field Data

All three techniques, the forward modelling of the magnetic field components and first and second derivatives have the capacity to recognise the shape and location of conductive bodies. The spatial derivatives however, are preferred as they have a set of simple relationships with the edges of an arbitrary shaped conductor as discussed previously.

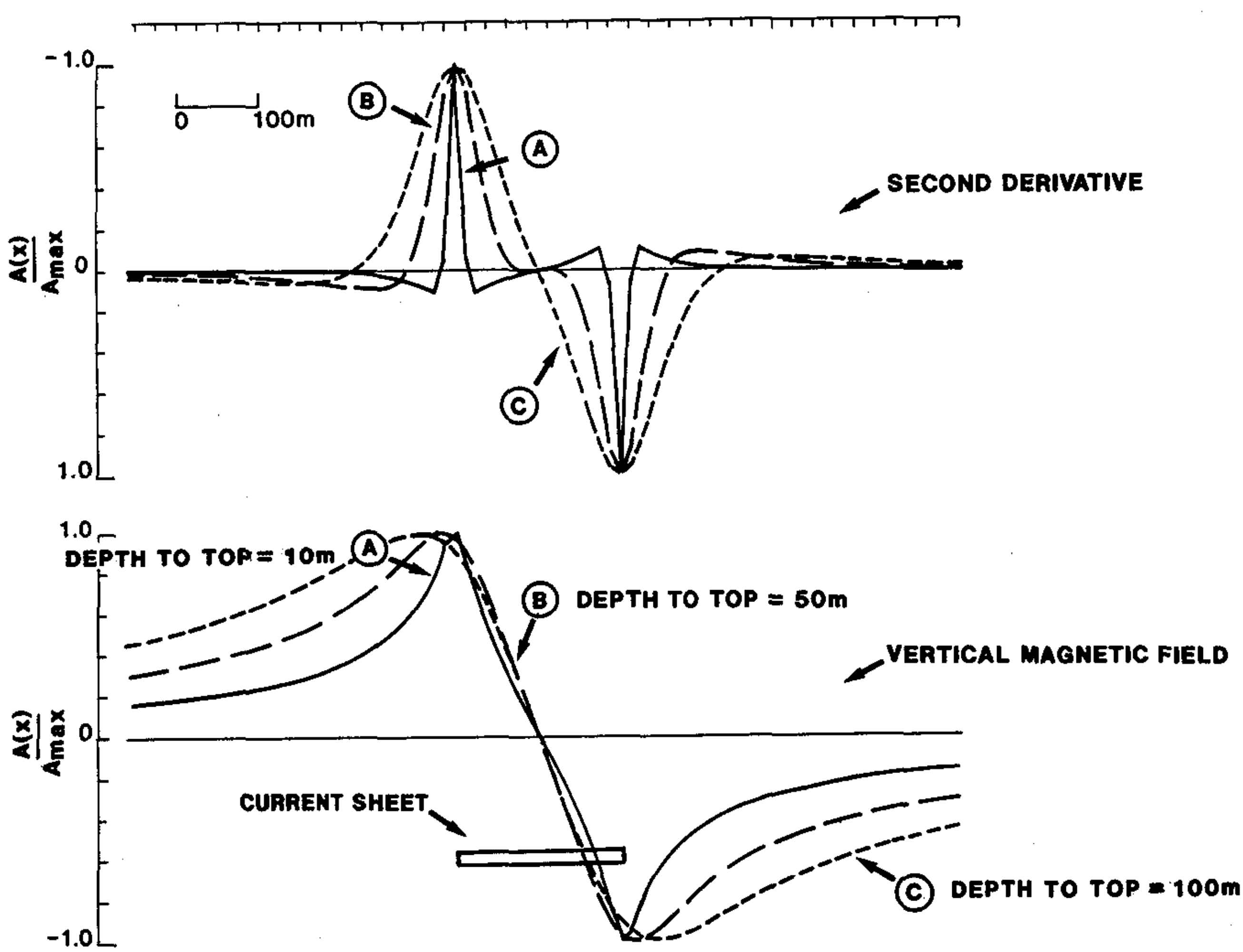

FIGURE 1
Normalized vertical (Hz) magnetic fields (bottom) and second horizontal derivatives (top) over a current sheet with a constant current. The profiles are normalized by their peak values, with the magnetic field showing cross-over type responses over the sheet, and the second derivative peaking over the edges of the sheet. The halfwidth of the second derivative over the edges is equal to depth to top. Peak to peak distances in the vertical magnetic field are greater than or equal to the width of the sheet. Second derivative peaks are close to the minima and the maxima in the vertical magnetic field.