In an independent study using Canadian magnitude data, Ericsson* derived the relationship

$$M_{R_g} = 2.7 + 1.2 \log Y \ . \qquad (10)$$

Equations (9) and (10) can be considered equivalent; they produce the same M_{R_g} value, within 0.1, over the yield range of interest.

Consider for purposes of illustration an explosion 10-second R_g wave and an explosion 20-second Rayleigh wave recorded on a 4 K magnification LPZ seismogram with a trace amplitude of 5 mm at an epicentral distance of 20°. Using equation (3), the M value of the explosion is 4.3. Using either equation (3), or the more appropriate formula of Basham (1970) which is equivalent in this distance range, the M_{R_g} value is 4.6. From equation (8) the M4.3 equivalent explosion yield is about 170 kilotons and from equation (9) or (10) the M_{R_g} 4.6 equivalent explosion yield is about 40 kilotons. With the trace amplitude used above recorded on about 4 stations in the distance range near 20°, and using the fact that one or more of the stations (say, LPZ arrays) can have a larger effective magnification, the situation described is roughly equivalent to the (90 per cent) Rayleigh wave detection thresholds described in Chapter 5. Thus the explosion identification threshold using the R_g wave is about 40 kilotons, or a factor of about 4 in yield better than the threshold using 20-second Rayleigh waves.

Consider now the extrapolation of northern hemisphere earthquake Rayleigh wave detection thresholds (section 5.4) to explosion identification thresholds. Using the formal calculations for 20-second earthquake Rayleigh waves incremented δm1.0 to convert to explosions, the explosion identification thresholds using M versus m will be about m5.6 in central North America, m5.6 to m5.8 for the remainder of North America, the north Atlantic Ocean and northern Europe, and m5.8 to m6.0 throughout the remainder of the hemisphere; a realistic average for the northern hemisphere is about m5.8 , or about 60 to 100 kilotons equivalent yield.

The Rayleigh wave detection threshold at any location in the northern hemisphere is highly influenced by the number of, and distance to, LPZ arrays within the 90° detection range. Since each of the LPZ arrays has data in a form suitable to matched filtering, the explosion identification thresholds can be reduced by about δm0.2 using this process, i.e., to about m5.4 in central North America and m5.8 in the poorest areas of the hemisphere, with a realistic average of m5.6 , or about 40-60 kilotons yield in hardrock.

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* CCD/306 , Swedish technical working paper for the Conference of the Committee on Disarmament, August, 1969.