Recently, Zhu *et al.*[17] and Chun *et al.*[18] extended the RTSM method and demonstrated that the extended version is capable of performing simultaneous determinations of the P_n geometrical spreading and the P_n attenuation. The demonstrations were carried out using a large body of P_n recordings from Eastern Canada Telemetered Network stations. The results show that stable path attenuation measurements can be made in the low attenuating Canadian Shield over distances as short as 100 to 200 km. Spatial resolution on this scale is a valuable asset in seismic monitoring of low threshold nuclear test ban treaties. A schematic drawing for the P_n waves can be seen in Figure 7.

Cloning: A Method of Seismic Network Calibration

While developing the RTSM attenuation measurement method, the University of Toronto team came upon a second discovery: a simple technique of turning all stations of a seismic monitoring network into nearly identical "clones," each capable of mimicking the characteristics of a pre-selected master station[19]. Technically, the procedure is called seismic network calibration. In essence, the core procedure in network calibration centres upon the determination of relative differences in the combined net effects arising from station geology and instrument characteristics. We have shown that such relative differences can in fact be measured very reliable for both the L_g wave[20] and the P_n wave[21] — using either RTSM or PSM (power spectral method), both developed by the University of Toronto team.

Once calibrated, the network stations will process the incoming seismic signal in the same manner, thus preserving any "earthquake-like" or "explosion-like" features that the arriving seismic signals happen to have, immediately before being subjected to near-station site effects and instrument errors. Also preserved is the relative signal strength — a crucial piece of information needed for the construction and subsequent use of the empirical magnitude/yield relation for estimating the size of underground nuclear explosions.

Network calibration largely eliminates the need for using multiple seismic records for each given event in order to "average out" unknown site effects and, to a lesser extent, instrument errors. By requiring fewer recording stations per seismic event, a calibrated seismic network has in effect a lower source identification threshold and is better equipped to handle adverse monitoring situations than is an uncalibrated counterpart. By virtue of their being individually calibrated to mimic the frequency response characteristics of a pre-selected master station, network stations can be relocated (to quieter or more strategic locations), refurbished, or added or deleted (one at a time) without incurring serious disruption to the ongoing monitoring activities.