

## MULTIPLES IN HARD WATER-BOTTOM AREAS

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In areas where the seafloor is comprised of hard sediments, multiple reflections can obscure the primary seismic energy. The water layer acts as a wave guide and source generated noise or unwanted signal is observed on the data. The backscattered energy from irregularities on the seafloor can be described in terms of acoustic normal modes and the more near vertical multiple reverberation energy can be described by analogy to the modes of vibration in a closed organ pipe. The paper demonstrates this analogy using recently recorded seismic data and discusses the potential to attenuate this energy utilizing arrays of seismic sources and acquisition parameter selection.