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Seismic attenuation (Q-1) for gas hydrate-bearing sediments in the Arabian Sea

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Any propagating seismic wave undergoes attenuation, determined in terms of inversely-related quality factor (Q). Presence of gas hydrate above the BSR stiffens the sediment matrix and exhibits high quality factor (Q) or low attenuation, whereas underlying free gas increases the Q below the BSR. Gas hydrate in a region is detected mainly by identifying an anomalous reflector, known as the bottom simulating reflector or BSR. Thus, estimating Q is important for both qualifying the hydrate occurrences and quantifying the amount. We propose a simple technique of deriving Q from prestack seismic reflection data based on the logarithm of spectral ratio (LSR). The method is applied to the seismic data in the Kerala-Konkan basin (KK) in the Arabian Sea. The Q (256$\pm$11) estimated over the region with a strong BSR is found to be more than double the Q (101$\pm$9) derived for the region without any BSR. We have extended the method and calculated interval Qs for the shallow sediments in the Makran accretionary prism in the Arabian Sea. The BSR is strong at CDPs 4234 and 4380, and weak near CDP 4532. The Qs for the layer just below the seafloor are estimated as 98, 108 and 103 at CDPs 4234, 4380 and 4532 respectively. The interval Qs for the hydrate-laden sediment are calculated as 188, 221 and 123 respectively, whereas the gas-bearing sediments show the interval Qs as 126, 136 and 141 respectively at the same CDP locations. The first layer with average Q of 103 can be considered as the background (hydrate and gas free) Q. We observe high Q above and low Q below the strong BSR, whereas the Q shows a moderate increase at the weak BSR. The higher Q with respect to that at no-BSR or weak BSR can be used as an important seismic attribute for qualifying whether a BSR is related to gas hydrate, and identifying gas hydrate and free gas.