Shi D, Milkereit BM, 2016, Seismic imaging in a low Q environment, Abstract, Roundup, Vancouver, BC

The very strong attenuation of seismic waves in the Athabasca Basin, Saskatchewan, was previously assumed to occur because of the presence of unconsolidated near surface materials (i.e. the overburden). However, we observe an extremely low Q over the entire extent (i.e. from 60 to 460 m) of the vertical seismic profiling (VSP) data acquired near McArthur River mine in 2007. Various measuring techniques performed on the near-offset dataset confirm that locally Q can be lower than 10. Q estimation methods used are time-domain amplitude decay, frequency-domain spectrum ratio, 1D equivalent traveltime inversion and forward viscoelastic waveform modelling. The Q is lower than all the values obtained from marine and land seismic exploration datasets associated with either gas anomalies or volcanic chambers. Meanwhile, high Q (i.e. >>100) observed from the offset VSP data (i.e. source located 300 m away from the near-offset one, and likely to be away from local alteration) indicates the attenuation condition can be correlated with sandstone alteration to a certain degree. Thus, a vertically occurring low-Q body (e.g. an attenuating plume) is a more realistic model to explain the strong attenuation rather than the overburden only model. Such environments are challenging for seismic imaging as the signal-to-noise ratio (SNR) is strongly reduced by loss of wave energy. We therefore expect to achieve an attribute model through Q tomography, and this will be utilized for compensation of the energy loss in the future processing of surface seismic data in the Athabasca Basin.

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