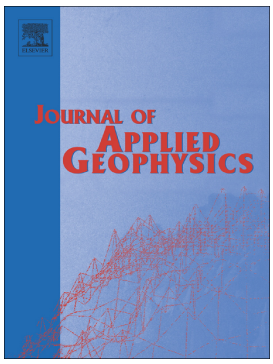

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Characterization of Rotary-Percussion Drilling as a Seismic-While-Drilling Source

Yingjian Xiao [a], Charles Hurich [b], Stephen D. Butt [a]

[a] Faculty of Engineering and Applied Science, Memorial University of Newfoundland, 230 Elizabeth Ave, St. John's, NL A1B 3X9, Canada
[b] Department of Earth Sciences, Memorial University of Newfoundland, 230 Elizabeth Ave, St. John's, NL A1B 3X9, Canada

E-mail address: yxiao@mun.ca (Y. Xiao, corresponding author), churich@mun.ca (C. Hurich), sdbutt@mun.ca (S.D. Butt)

Abstract

This paper focuses on an evaluation of rotary-percussion drilling (RPD) as a seismic source. Two field experiments were conducted to characterize seismic sources from different rocks with different strengths, i.e. weak shale and hard arkose. Characterization of RPD sources consist of spectral analysis and mean power measurements, along with field measurements of the source radiation patterns. Spectral analysis shows that increase of rock strength increases peak frequency and widens bandwidth, which makes harder rock more viable for seismic-while-drilling purposes. Mean power analysis infers higher magnitude of body waves in RPD than in conventional drillings. Within the horizontal plane, the observed P-wave energy radiation pattern partially confirms the theoretical radiation pattern under a single vertical bit vibration. However a horizontal lobe of energy is observed close to orthogonal to the axial bit vibration. From analysis, this lobe is attributed to lateral bit vibration, which is not documented elsewhere during RPD. Within the horizontal plane, the observed radiation pattern of P-waves is generally consistent with a spherically-symmetric distribution of energy. In addition, polarization analysis is conducted on P-waves recorded at surface geophones for understanding the particle