Re-evaluation of deep moonquake source parameters and implication for thermal condition of deep lunar interior.

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While deep moonquakes are seismic events commonly observed on the Moon, their source mechanism is still unexplained. The two main issues are poorly constrained source parameters and incompatibilities between the thermal profiles suggested by many studies and need for brittle properties at these depths. In this study, we reinvestigated the deep moonquake data and uncover the atypical feature of deep moonquake that completely differs from those of the Earth. We first improve the estimation of source parameters through spectral analyses using virtual “new” broadband seismic records made by combining those of the Apollo long and short period seismometers. We use the broader frequency band of the combined spectra to estimate corner frequencies and DC values of spectra, which are important parameters that constrain the source mechanism. We use the spectral features to estimate seismic moments and stress drops from 3 deep moonquake source regions. Secondly, we show that the large strain rate from tides makes the use the new sets of source parameter and re-evaluate brittle-ductile transition temperature at deep moonquake source regions. We finally take the temperature as an additional constraint and estimate the temperature profile that is compatible with deep moonquake occurrence and other geophysical observations such as surface heat flow measurements and geodetic observations.

Keywords: Lunar Science, Seismology, Planetary Science

