Analysis of Rediscovered Data from Apollo 17’s Lunar Seismic Profiling Experiment: Evidence for Events Associated with Sunrise

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Introduction and Goals

- Three goals for this study:
  - Identify additional detections of deep moonquakes from Apollo 17 LSPE data that correlate with Apollo 12–16 PSE data
  - Correlate meteorite impacts from Apollo 15 and 16 PSE SP data and Apollo 17 LSPE data
  - Investigate potential of using Apollo 17 LSPE geophones as a small-aperture array to locate thermal events
- Apollo 12, 14, 15, and 16: Passive Seismic Experiment (PSE) with Long Period (LP) instruments and a Short Period (SP) instrument components
- Apollo 17: Lunar Seismic Profiling Experiment (LSPE) with 4 geophone components
- LSPE data (Aug. 15, 1976 – Apr. 24, 1977) was never thoroughly analyzed neither independently nor in conjunction with simultaneous seismic measurements made at Apollo 12, 14, 15, or 16.

Deep Moonquakes and Meteorites

- Deep moonquake analysis focused on the moonquake clusters closest to the Apollo 17 site: A1, A6, A7, A18, and A22.
- Correlation analysis affected by sensitivity of instruments. PSE SP and LSPE geophones frequency ranges overlap, while PSE LP instruments have a lower frequency range.
- Meteorite impact analysis focused on the 31 known meteorite impacts detected at one or more Apollo stations during the LSPE data range.
- Apollo 17 geophones were not designed to measure distant events, and meteorite impacts close to the other stations were likely not large enough to produce seismic energy detectable at such large distances.

Thermal Events

- Identified diurnal enhancements of events
- Hand analysis: two enhancements of events with a gap of 9 hours at sunrise
- Hidden Markov Models (HMMs): enhancements of events at both sunrise and sunset
- Arrival times identified for 609 events
- Classifications waveforms (temporal distribution)
- Preliminary arrival direction analysis (azimuth)

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References