

TIDAL INFLUENCES AT THE LUNAR CRATER ARISTARCHUS AND TRANSIENT LUNAR PHENOMENA. A. C. Cook¹, ¹Institute of Mathematics and Physics, Aberystwyth University, Aberystwyth, SY23 3BZ, United Kingdom. Email: atc@aber.ac.uk.

Introduction: Transient Lunar Phenomena (TLP) refer to short-lived apparent changes, seen by Earth-based astronomers, against the lunar surface. Crotts [1] presented a comprehensive summary of associated observational evidence and theories to explain such phenomena. In this abstract a case study related to Earth tides is investigated, namely: Chapman [2] in 1967, and Middlehurst [3] in 1972, suggested respectively that there was a correlation between vertical Earth tidal pull and Transient Lunar Phenomena (TLP) activity associated with the lunar crater Aristarchus. Evidence for this was presented in the form of a sinusoidal plot that the authors claimed showed that TLP coincided close to local maxima or minima of vertical tides at Aristarchus. The authors explained the results by suggesting that tides enhanced the compression and decompression of cracks in the lunar surface, and that these gave rise to episodic releases of underground gas.

The above finding was investigated here using more recent observational data available to the author [4], and in addition utilizing a dataset of representative routine observations where no-TLP were seen, hence forth referred to as nulls. The nulls were used to illustrate where potential selection effects could occur.

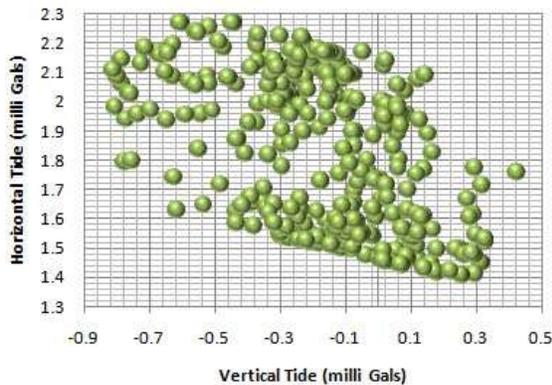


Figure 1. Null observations plotted on a horizontal versus vertical Earth tide graph, for the crater Aristarchus.

Method: Horizontal and vertical tides were calculated using the equations given by Chapman [2]. Unlike Middlehurst and Chapman though, TLPs were weighted according to an observational quality criterion [4] where 1 represented a less reliable TLP account than a 5. Nulls and TLP data points were plotted separately on horizontal tide versus vertical tide graphs. If, as the two past studies suggested that TLPs in Aristarchus were tidally related, then the two plots

should differ visually and more TLP should occur at extremes of vertical tides, or in clusters.

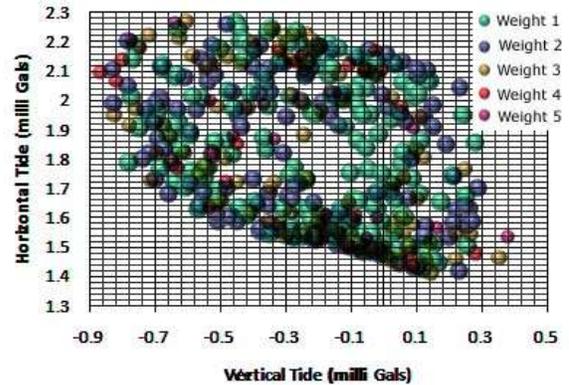


Figure 2. Weighted TLP observations plotted on a horizontal versus vertical Earth tide graph, for the crater Aristarchus.

Results: The distribution of TLPs on the horizontal versus vertical tidal plot looked visually very similar to the distribution of nulls. No clustering of TLPs, especially the higher weight TLPs, could be found. However it was noted that some weight 3-5 TLPs appeared at extremes of the vertical tide.

Conclusion: The evidence presented by Chapman and Middlehurst for a tidal influence on TLPs associated with Aristarchus is weak, but cannot be ruled out for all cases. Work will continue on looking for evidence of tidal association with TLP for other lunar craters.

References:

- [1] Crotts, A.P.S. (2009) *Astrophys. J.*, 697, 1-15.
- [2] Chapman W.B. (1967) *JGR*, 72, 6293-6298. [3] Middlehurst, B.M. (1972), *The Moon*, 450-457.
- [4] Cook et al. (2010) *EPSC2010*, Abstract #768.

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