

THE RELATIONSHIP OF RILLES AND HIGH MAGNESIUM MATERIAL IN THE CAUCHY REGION OF THE MOON. P.L. Strain and C.G. Andre, National Air and Space Museum, Smithsonian Institution, Washington, DC 20560

It has been noted previously that some graben-like lunar rilles are associated with high magnesium materials as measured by the X-ray fluorescence experiment on Apollo 15 and 16 (1). Relatively high Mg values have been observed in the vicinity of such straight rilles in both terra and mare regions. For example, graben in the terra northeast of the crater Capella lie in a region where Mg/Al values are well above those of the nearside terra mode (1). In addition the region around the Apollonius rille, located in terra materials at the northern edge of Mare Fecunditatis, is characterized by very high Mg values. Graben in southern Mare Serenitatis in the vicinity of Menelaus crater are associated with basalts that exhibit Mg concentrations higher than the units surrounding them. In this paper, the Cauchy rilles in eastern Mare Tranquillitatis are examined as part of a comprehensive study to investigate the chemical setting around all graben-like rilles within orbital X-ray coverage, and to determine the relation, if any, between chemical composition and the rilles.

The northernmost of the Cauchy rilles (here called Rille 1 for convenience) is a flat-floored graben that trends roughly N65°W and extends for about 300 km from the eastern boundary of Tranquillitatis. The southern "rille" is predominantly a scarp, that parallels Rille 1 and exhibits the two-sided graben form only in isolated spots along its course. The lowest Mg values in the region are found in the elevated area between the two rilles. Directly to the north of Rille 1, values start to increase culminating in a very high Mg/Al ratio (> 1.7) associated with a topographic low directly to the north. In fact, an excellent inverse correlation exists between terrain level and Mg concentration in this area.

Mg/Si trends in the region correlate exceedingly well with rille orientation. The arrow on Fig. 1 shows that rille orientation also closely parallels the Apollo 15 orbit tracks which determine the distribution of the data. Therefore, care must be taken not to interpret interorbit variations due to changes in solar activity as different chemical provinces. However, several orbits were examined on digital Mg/Al images and all indicate a distinct anomaly unrelated to orbit tracks (Fig. 1). Raw X-ray data of two orbits directly north of Rille 1 also show a trend of increasing Mg/Si values with proximity to the rille.

The deepest part of the topographic low north of Rille 1 corresponds to a small patch designated younger than the surrounding mare based on crater density (2). In addition, faint curvilinear structures suggest flow fronts indicating movement away from the rille (downhill). These factors coupled with the anomalous chemical composition suggest an isolated mare unit localized in the topographic low. The correlation of the rille, Mg/Al trends, topography, and age implies there is a direct relation between the rille and the high Mg/Al unit. It has been noted in other regions that linear rilles are sometimes related to volcanic features (pyroclastics, flows, constructional features, pits) (3,4). The association between the rille and the high Mg material does not necessarily imply that the rille is the direct source of that material although this is not ruled out. Alternatively the graben, signifying that the region has been tectonically active in the past, may indicate the presence of other extensional tectonic features (now buried by the latest periods of extrusion) which controlled the emplacement of the material.

CAUCHY RILLE

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References: (1) Andre C.G. and Strain P.L. (1983) JGR, in press. (2) Boyce J.M. (1977) Proc. Lunar Sci. Conf. 8th, Frontispiece. (3) Bryan W.B. et al. (1975) Proc. Lunar Sci. Conf. 6th, p. 2563-2569. (4) Schultz P. (1972) Moon Morphology, Univ. Texas Press.

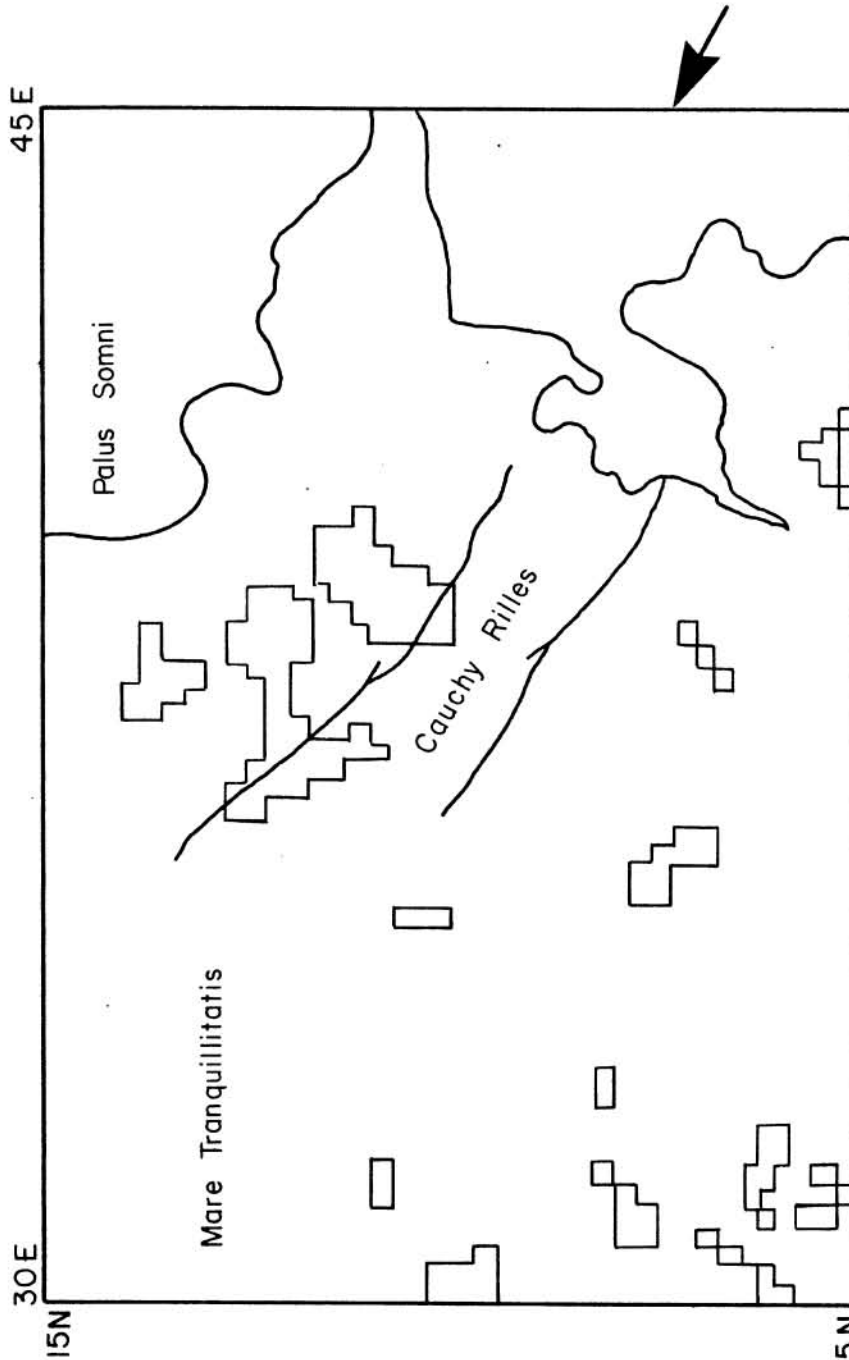


Fig. 1. Sketch map of region around Cauchy Rilles. Boxes mark areas with Mg/Al ratios ≥ 1.6 . Arrow indicates trend of Apollo 15 orbit tracks.