A RETROSPECTIVE LOOK AT KREEP. R. L. Korotev, Department of Earth and Planetary Sciences, Washington University, St. Louis MO 63130, USA (rlk@levee.wustl.edu).

Nearly any general or introductory treatise on the Moon explains that, based on albedo and surface morphology, the Moon consists of two kinds of terrain — the maria and the highlands. Pervasive in the lunar literature is the notion that the provenance of lunar igneous rocks is similarly black and white, that is, rocks are either "mare rocks" or "highlands rocks." This classification persists despite the that we have had evidence for more that 25 years that a dichotomous system based on surface albedo and morphology is inadequate geochemically. The perception that 'nonmare = highlands' has been a significant impediment to the understanding of lunar geology and geochemistry, an impediment that is only now beginning to be falter [1,2]. In particular, the practice of regarding KREEP-rich rocks and those plutonic rocks which appear to derive from KREEP-rich magmas as "highland rocks" assumes and implies a degree of proximal relationship between KREEP magma and the feldspathic highlands crust that may never have existed. The faith in the dichotomy has driven the science. Models that locate ur-KREEP, the residual liquid of crust formation [3], globally in a layer beneath the feldspathic crust have assumed the mare-highlands dichotomy, largely ignoring long-existing evidence for the asymmetric distribution of KREEP [4] and the lack of KREEP in the ejecta of basins outside the Procellarum region (e.g., Nectaris [5]).

In retrospect, the acceptance of KREEP-bearing rocks as highlands rocks is an accident of landing site location, order of discovery, and nomenclatural confusion. We did not know at the time of Apollo site selection that much of the accessible area of the Moon was in the geochemically anomalous area revealed by the Lunar Prospector gamma-ray spectrometer [6]. Had we had, prior to the Apollo missions, a map of the distribution of radioactivity on the lunar surface, the rocks of the Fra Mauro formation would never have been regarded as highlands rocks because the need for a more complicated classification system would have been self-evident. Global chemistry combined with geomorphology would have clued us that the crust of the Procellarum KREEP Terrane had to have formed very differently than that of the Feldspathic Highlands Terrane [1,2,7–9]. Comparison of maps of radioactivity and albedo might instead have lead to the conclusion that KREEP was associated more closely with the maria than the feldspathic highlands.

Wilhelms [10, p. 258] notes that the existence of "highland basalt" was anticipated at the time of Apollo 14. Impact-melt breccias were a lithology generally unknown among terrestrial geologists. Thus, because KREEP-bearing melt rocks and breccias are basaltic in mineralogy and texture but are apparently unrelated to the maria, they were called highland basalts. The highlands tie was strengthened when KREEP-bearing breccias were also found at Apollo 16, the landing site expected (based on albedo and geomorphology) to be most typical of the highlands. That all such breccias might be ejecta emplaced on the highlands surface by one or a few impacts into an anomalous terrane [1] was not considered. What if we had had lunar meteorites, most of which are feldspathic and KREEP-poor, before we had gone to the Moon to collect samples? Would ferroan anorthosite, KREEPy breccias, Mg-suite norites, and alkali anorthosites all still be pigeon-holed as highlands rocks?

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