LUNAR LIGHT PLAINS: AGES AND COMPOSITION; S. Engel, G. Neukum, R. Jaumann and E. Nagel, DFVLR Oberpfaffenhofen, Institute for Optoelectronics, Planetary Remote Sensing Section, 8031 Wessling, FRG

Light plains are areas on the moon which show smooth surfaces. Their albedo is generally lower than the albedo of surrounding highland material (12%-13%), but not as low as the albedo of mare units (5%-6%). The examined plains belong to the Cayley formation and are situated between the Apollo 14 and the Apollo 16-landing site. The origin of these plains is discussed in different ways. One explanation for the formation of lunar light plains (Cayley plains) is their deposition as highly fluidized debris, that traveled beyond the presently recognizable extent of the Imbrium basin ejecta (1), or that Imbrium basin ejecta was mixed by secondary cratering with local material and deposited locally in low lying areas (2). Another explanation is a specific form of emplacement by highland volcanism (3,4,5,6,8).

The crater populations of the examined Cayley plains (3,4,8) show the following results for relative and absolute crater retention ages:

1. The plains exhibit a variation in relative ages i.e., cumulative numbers per km² at D=1km, of between 0.7·10⁻² and 3.4·10⁻² km⁻². In terms of absolute ages (cratering chronology after (7)) this means, that between 3.6 and 3.9 AE these Cayley plains were formed and that not all of these plains were formed contemporaneously with a basin-forming event (Imbrium, Orientale, Nectaris) (Figure 1).
2. Most of the light plains investigated are clearly younger than the last basin-forming process, the Orientale event. These plains are located between 0° and 10°E and between 0° and 15°S (Figure 3).

The analysis of spectrophotometric data (determination of the FeO content of the Cayley plains) yields the following results (Figure 2):

1. The surfaces of these plains show FeO contents between 4 wt% and 12 wt%.
2. In the central highlands the FeO content of the Cayley plains decreases from west to east (12 wt% - 4 wt%).
3. The light plains of the Fra Mauro region exhibit high FeO contents (7 wt% - 9 wt%). Some light plains in the central highlands have very high FeO contents (8 wt% - 12 wt%) (like Ptolemaeus, Alphonsus and Albategnus).

A summary conclusion of the results (age determination and chemical composition) is:

The light plains of the Apollo 16-landing site are the oldest (Imbrium age) and the plains with the lowest FeO content (4 wt%). In this case none of the both genetically possible processes (impact or volcanism) can be excluded in our studies.

The light plains in and around the crater Ptolemaeus cannot have been formed by basin ejecta, because of low ages (younger than the Imbrium event and partly younger than the Orientale event) and of high FeO contents (higher than the FeO content of highland rocks). It is concluded that the surface material of these plains formed by endogenic activity (possibly an Al-rich highland volcanism).

In the Fra Mauro region high Th-U-K values were found and the hypothesis of a KREEP volcanism was proposed (5). Our results support this view, because the light plains (fillings of the craters Fra Mauro, Bonpland, Parry and Guericke) show ages between 3.7 and 3.9 AE and high FeO contents.

The results of these two data sets (ages and chemical compositions) show that the majority of the Cayley plains must have been formed by a local, endogenic process and not by deposition of lunar basin ejecta.

References:

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Histogram of the frequency of occurrence of all light plains investigated (3,4,8) as a function of relative crater retention age (A cumulative crater frequencies at D=1 km).

The FeO content of the examined Cayley plains is plotted against their longitudinal position on the moon (latitude 0° - 15°S). In the central highlands the FeO content decreases from west to east. The light plains of the Fra Mauro region exhibit a similar chemistry among themselves.