REMOTE SENSING OF THE CAYLEY PLAINS AND IMBRIUM BASIN DEPOSITS. F. Hörz, NASA-JSC, Houston, TX 77058, V.R. Oberbeck, NASA-Ames, Moffett Field, CA, 94035 and R.H. Morrison, LFE Corp., Richmond, CA 94804

The combined effects of primary and, particularly secondary impacts represent an effective mechanism for large scale lunar mass wasting(1). Accordingly the Cayley formation which occurs in topographic lows is interpreted to be of local to regional derivation. This hypothesis contrasts with other interpretations that suggest an association with either the Imbrium or Orientale basin forming event, if not both(3,4,5). Furthermore, Oberbeck et al. (this volume) demonstrated that secondary cratering results in significant amounts of freshly excavated and/or reworked ejecta masses. As a consequence cratering deposits at sufficient distances from the primary event, but still well within the continuous ejecta blanket, must contain components of extremely local origin. These new concepts are evaluated using information from the orbital, geochemical experiments and field observations from the Ries Crater.

Remote Geochemistry: The geochemical investigations along the Apollo 15 and 16 ground tracks need to be consistent with any hypothesis on the origin of Cayley, e.g., the Gamma Ray Experiment revealed the concentration of radioactive species (U, Th, K) with a spatial resolution of 2° (6). We measured the fractional surface area per gamma ray resolution cell that is mapped as Cayley plains(2) with the aid of a planimeter. These measurements are superimposed on the gamma ray data in fig. 1. There is no positive correlation of radioactivity and presence of Cayley type materials. Mapped contacts of the Cayley unit with other geological formations are not sensed by the gamma ray spectrometer. These data are consistent with-if not supporting-a localized origin for the Cayley formation. Similar conclusions can be derived from the X-ray fluorescence data(7), the alpha particle spectrometer results(8) and the albedo measurements(9).

The "Fra Mauro-", "Montes Alpes-" and "Montes Appenninus" formations are associated with the Imbrium Basin formation and are either genuine ejecta (FM) or possibly covered by ejecta (M. Ae and M. Ap) according to(2). Their comparison with the gamma ray results is illustrated in fig. 2. Again no geological contacts are sensed by the gamma ray experiment. Due to the small total surface area overflown, "sampling statistics" are poor and interpretations are very limited. They appear, however, to be consistent with the view, that local components are incorporated into ejecta blankets by secondary cratering.

Ries Crater: The Ries Crater (22 km diameter) is the largest terrestrial impact structure with parts of the ejecta blanket preserved(10). Hüttner shows that sands and marls which demonstrably were never present in the area of the actual crater cavity may make up significant parts of the Ries ejecta blanket (locally >20%) at distances of >10 km from the present crater rim. Limestone boulders from the Miocene cliff line (≈8-10 km S of rim; easily spotted, because of mollusc [pholad] bore holes) are particularly good markers and are found as far as 3 km to the S of their original position in breccias that are, furthermore, topographically 80 m higher than the Miocene sea level. These observations demonstrate that lunar ejecta deposits, e.g., the Fra Mauro formation, may consist of locally derived materials to a much larger extent than previously thought.

CAYLEY PLAINS AND IMBRIUM DEPOSITS

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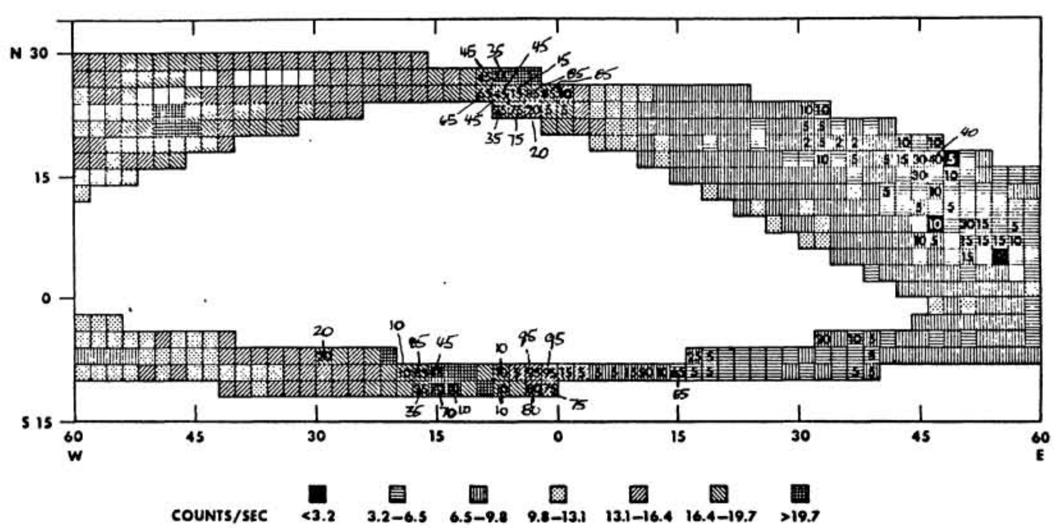

Fig. 1: Comparison of Gamma Ray Experiment and Cayley Plains. Numbers in or next to individual resolution cells indicate amount of Cayley (surface %) present within each cell.

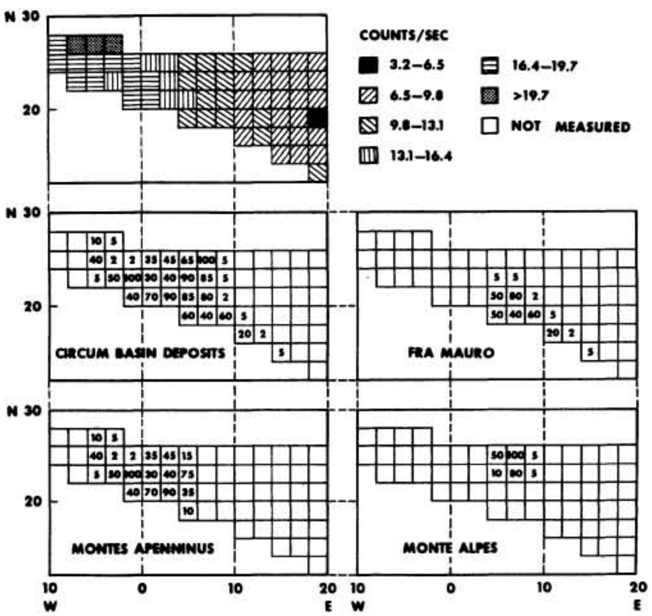

Fig. 2

Fig. 3

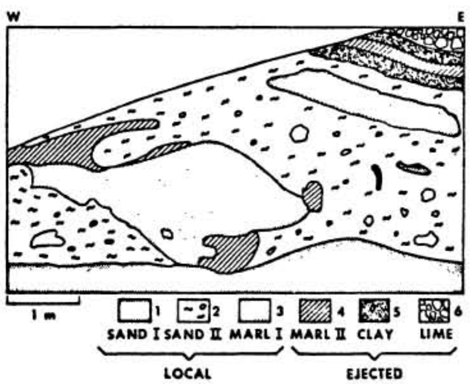

Fig. 4

Fig. 2: Comparison of Gamma Ray Experiment and Imbrium deposits. "Circum Basin Deposits" are defined as F.M.+M. Ap+M.Al. Numbers in squares again refer to % surface area covered per cell by the respective unit(s).

Fig. 3: Ries ejecta ("Bunte Breccia"), crater-rim and position of Miocene shoreline. Local components mixed into the ejecta can easily be recognized S of the shoreline (after 11).

Fig. 4: Detailed field sketch of Ries Crater ejecta about 12 km S of present crater rim. Note abundance of local material contributing to the breccia deposit (9).

Fig. 2 Courtesy *Geologica Bavarica*, 61, 142-201, 1969.