THE GARGANTUAN BASIN - SOME IMPLICATIONS; P.H. Cadogan, Dept. of Physics, University of Sheffield. U.K.

The existence of a vast, previously unrecognised, basin on the lunar nearside has already been proposed (1), largely on the basis of remote measurements. The extrusion of KREEP lavas into this basin provides an explanation for the measured distribution of radioactive elements on the lunar surface (2) which is more satisfactory than, but does not conflict with, the orthodox theory of single-stage excavation of KREEP from the Imbrium basin. The Imbrium impact itself would thus have been a second order effect by comparison and, being entirely within the Gargantuan basin, would have resulted in uplifted mountain ranges (e.g. the Lunar Appenines) and ejecta deposits (the Fra Mauro formation) which are richer in KREEP than anorthosite. This model is therefore fully compatible with the lower aluminium: silicon ratios measured in these regions by the X-ray flourescence experiments (3) and with the unexpected dearth of anorthositic rocks and the predominance of KREEP at the Apollo 14 site and at the Appenine front (4). A lower limit for the age of the Gargantuan basin is then set by the rubidium-strontium whole rock 'isochron' age for KREEP of 4.2 - 4.3 Gy (5).

The formation of the Gargantuan basin would have had a profound effect on the moon as a whole. The basin therefore provides an opportunity to make certain physical and chemical predictions about the moon, some of which could be readily tested by remote sensing experiments on a lunar polar orbiting satellite.

Identification of basin ejecta deposits

The 'excess' thickness of crust on the lunar farside (6) may be the result of deposition of crust ejected by the Gargantuan basin. If so, by symmetry, there should be similarly elevated regions to the south and east of the farside depression which, on the basis of laser altimetry, is centred at 180°E 45°S.

Identification of antipodal and concentric shock features

The size of the Gargantuan impact suggests that there should be recognisable spall features at its antipodes. The deep depression on the lunar farside (6), although considerably displaced from the antipodes, could have originated in this way. Concentric ring structures around the basin should presumably also exist but these have not yet been identified.

Remote chemical analysis

All non-mare features within the Gargantuan basin, including the Juras, Alps, Appenines, Carpathians, the Fra Mauro formation, and the ejecta deposits and rims of large craters, should yield radioactive count rates and aluminium: silicon ratios which are characteristic of KREEP rather than anorthosite. There should be essentially no anorthositic

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crust remaining within the confines of the basin. The possibility exists that young volcanic provinces in Oceanus Procellarum, such as the Aristarchus plateau (which is known to be highly radioactive) and the Marius hills, may consist of KREEP which was remelted by, and extruded through, a hot blanket of mare lavas.

Isotope chronology

The only samples of KREEP within the Gargantuan basin should be of Imbrium age or younger. Rocks older than 4.0 Gy can only be reasonably expected outside the basin. Several such ancient rocks have indeed been found in these areas (e.g. 78155, 4.24 ± 0.04 Gy (7); 67483, 14, 2, 4, 4.24 ± 0.05 Gy (8); 78503, 13A, 4.28 ± 0.03 Gy (9)) which, being comparable in age to the KREEP whole rock 'isochron', may have been Gargantuan ejecta. This Gargantuan cataclysm makes the problem of finding rocks older than 4.3 Gy even more acute.

Mascons

Even if the lunar crust was fully rigid at the time of extrusion of the KREEP basalts, which is most unlikely, the low density of KREEP would have prevented Oceanus Procellarum from having a mascon analogous to those produced much later in the circular basins by high density mare basalts. The subsequent flooding of this area with mare basalts may not have been of sufficient thickness to produce a mascon 3.2 Gy ago.

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