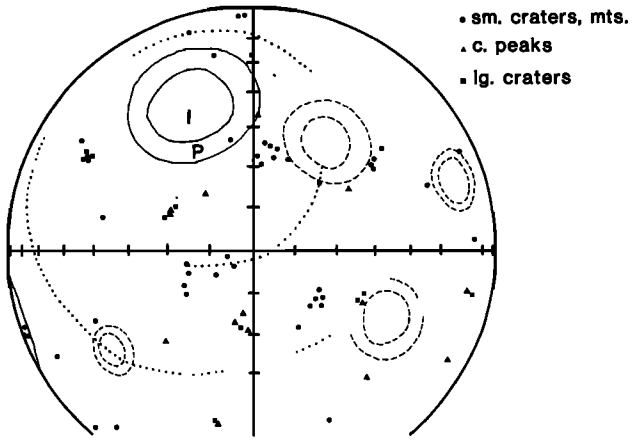


Fig. 16. Sketch map of the lunar near side showing the location of the areas listed in Tables 1 and 2. The oversized circles indicate small craters or mountains included in this study; oversized squares indicate walls associated with large craters, and oversized triangles indicate central peaks. The major basins are outlined according to their approximate age: Imbrium (solid lines, youngest), Nectarian (dashed lines), and the hypothesized Pre-nectarian Procellarum (dotted lines). The large "I" and "P" indicate the proposed center for the Imbrium and Procellarum basins, respectively.

of these craters and their surroundings in order to account for why some areas (for example, N-3) have been spared disruption more than others.

The distribution of crustal material containing or being dominated by gabbroic components is shown in the lower left of Figure 17. In spite of the small number measured, the distribution of crustal material with gabbroic composition is quite different from the global distribution of norites in Figure 17: gabbroic compositions occur preferentially in the western hemisphere. If gabbro is a significant pristine crustal rock type, as suggested by the peak V data, its lack of emphasis in lunar sample discussions may simply be a sampling limitation due to the fact that most samples were collected from the eastern hemisphere (see Figure 1). A parallel limitation is known to occur in studies of lunar basalt samples where less than a half of identified basalt types have been sampled directly in significant quantities and the majority of unsampled lunar basalts occur in the western maria [*Pieters*, 1978].

The distribution of both anorthosites and troctolites included in the lower right of Figure 17. Additional data is clearly needed to draw any solid inferences from their distributions. If these data are not misleading, however, most of the olivine-rich troctolites (those at Aristarchus and Copernicus) may owe their current surface existence to one of the earliest and largest (possible) basin-forming events in lunar history, namely, that which is thought to have created the Procellarum basin and perhaps thinned the lunar crust permanently in that region (see discussions by *Wilhelms* [1985] and by *Pieters and Wilhelms* [1985]).

These distributions of compositional rock types document the complexity and lateral heterogeneity of the lunar crust. They do not, however, illuminate what is in fact still a major observational paradox: On the other hand, the composition of the megaregolith is relatively homogeneous with noritic material being the dominant near-surface rock type. The deeper (5 to 15 km) crustal material, on the other hand, is not only compositionally very heterogeneous (gabbros, anorthosites, minor norites, and troctolites) but because of the observed major differences in proportion of rock types, cannot be the direct parent of the megaregolith.

Given this dilemma, a few possible solutions should be proposed to be tested. They fall into two categories: one emphasizes our limited knowledge about the early evolution of the moon, the other our limited technical capabilities in measuring and interpreting new data. Acceptance of the implications of these data indicates that contrary to common assumptions the upper lunar crust is clearly stratified, as was argued by *Ryder and Wood* [1977]. The compositional stratification of the highland crust observed in these reflectance data is an uppermost zone (megaregolith) dominated by noritic breccias overlying a very spatially heterogeneous middle crust containing regions (many kilometers in dimension) of anorthosites, gabbros, norites, and troctolites. This compositional stratification could have occurred (1) during crustal formation (crystallization sequence in a possible magma ocean), (2) just

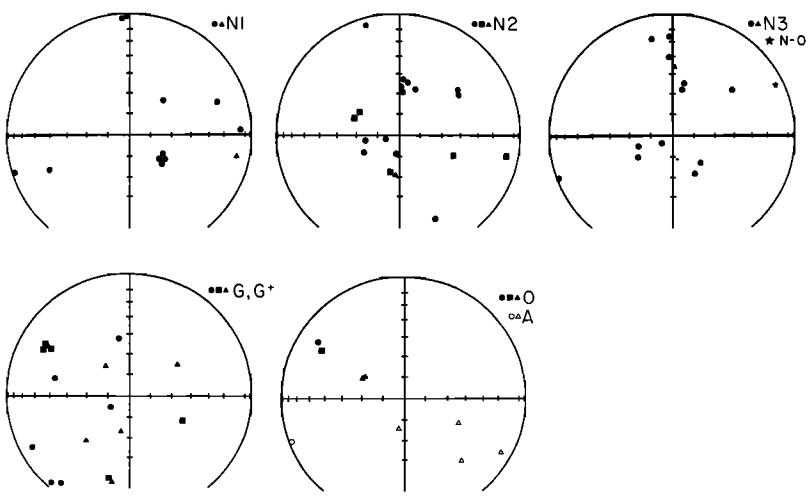


Fig. 17. Sketch maps of the lunar near side indicating the location with oversized symbols for small lunar areas listed in Tables 1 and 2. The top three maps indicate the distribution of areas with a noritic composition (N-1, N-2, and N-3). The bottom left map shows the distribution of observed areas of gabbroic composition (G and $G^+$). The bottom right map indicates lunar areas of anorthosite composition with open symbols (A) and areas of troctolitic composition (O) with solid symbols.