THE RIDGED PLAINS AS A POSSIBLE LANDING SITE FOR THE MARS SAMPLE RETURN MISSION. Nadine G. Barlow, Lunar and Planetary Institute, Houston, TX 77058.

Differences in the shape and density of crater size-frequency distribution curves have been interpreted as indicators of different impactor populations (1) (Fig. 1). Within the inner solar system two production populations are seen. The signature of the first is recorded in the heavily cratered regions of the moon, Mercury, and Mars and displays a multi-sloped distribution curve which cannot be described by a power law function at all crater diameters. The signature of the second population is seen in the lightly cratered lunar and martian plains, where the size-frequency distribution curve can be approximated by a power law function of -3 differential slope in the 8- to 70-km diameter range. Based on data obtained from the Apollo lunar samples and crater flux estimates, the first population is believed to have been emplaced during the period of heavy bombardment, which, at least on the moon, ended about 3.8 BY ago. The second population has dominated the cratering record since that time and is commonly assumed to be due to comets and asteroids.

The objects responsible for the period of heavy bombardment may have been left over accretional remnants (2), pieces of a gravitationally disrupted planetismal (3), or comets (4). Dynamical calculations for objects with most of these origins indicate that the end of heavy bombardment was approximately simulataneous within the inner solar system (3, 4). However, computer simulations indicate that if accretional remnants were responsible for the cratering record during this period, the end of heavy bombardment may have been extended at Mars by up to a billion year over that at the moon (2). Since a major assumption in the derivation of martian absolute age chronologies is the simulataneous termination of heavy bombardment at the moon and Mars (5, 6), the dating of the end of heavy bombardment is of great scientific interest to martian researchers.

The ridged plains units of Mars are primarily equatorial regions characterized by flat plains transected by numerous wrinkle ridges. The moderately cratered surfaces of these units shows a crater density between that of the heavily cratered southern uplands and the lightly cratered northern plains, indicating an age intermediate between these two extremes (7, 8). Crater size-frequency distribution curves of these regions have shapes similar to curves seen in the heavily cratered highlands, but at lower crater densities (8). The ridged plains appear to be the last unit to record the signature of the heavy bombardment period and thus probably formed near the end of this period (Fig. 2). The dating of rock samples from a ridged plains region could provide information necessary to determine if the end of heavy bombardment was an approximately simulataneous event throughout the inner solar system. This information has

implications not only for the martian absolute chronologies but also for constraining the origins of objects responsible for the cratering record during the period of heavy bombardment. Additionally, since these plains are generally believed to be of volcanic origin, samples will provide compositional information of an intermediate stage of martian volcanism.

The selection of a landing site for the Mars Sample Return Mission near a ridged plains-northern plains boundary would provide opportunities for sampling terrains dating from both the heavy bombardment and post heavy bombardment periods and help place constraints on when the end of the heavy bombardment period occurred. A site in northeastern Lunae Planum is suggested because of its proximity to younger northern plains units and to channel outwash, where samples of material from further upstream may be collected. Locations in Syrtis Major Planum and Sinai Planum, although not offering the geologic diversity of the Lunae Planum proposed site, would also permit collection of rock samples from plains-ridged plains boundaries.

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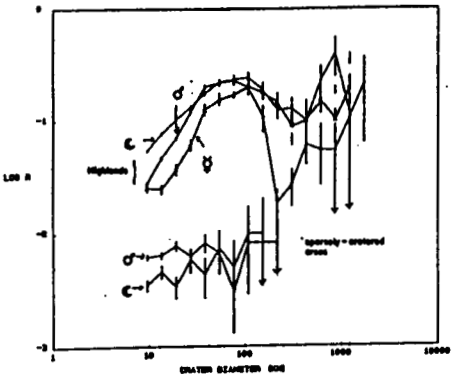

Fig. 1

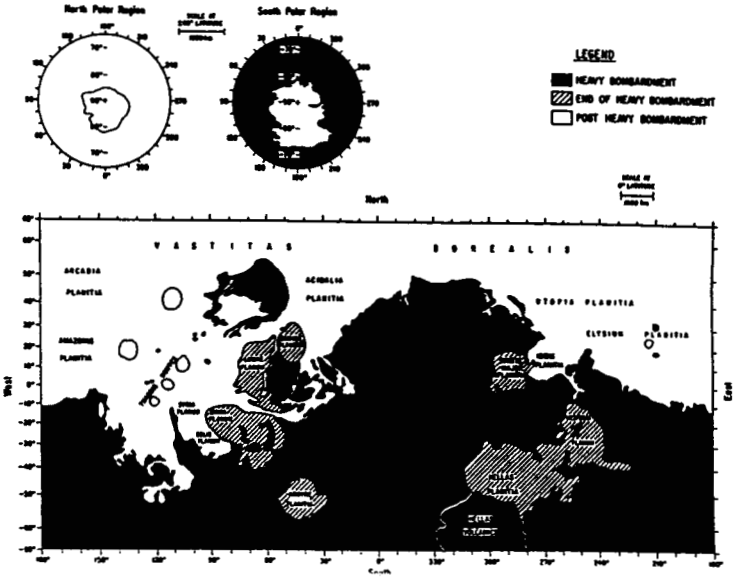

Fig. 2