RESURFACING IN COPRATES AND THICKNESS OF THE RIDGED PLAINS; Herbert Frey, Goddard Space Flight Center, Greenbelt, MD 20771 and Tammie D. Grant, Astronomy Program, University of Maryland, College Park, MD 20742.

Major resurfacing events on Mars can be identified through analysis of the cumualtive frequency curves using the Neukum and Hiller (1) technique. The curve is broken into branches (corresponding to different crater retention surfaces) where it departs from a standard production curve. The technque is highly dependent on the choice of production curve, and works best for resurfacing events that are efficient at removing craters and relatively discrete events (occurring over a time which is short by comparison with the repopulation time). We have shown the technique is useful for identifying major resurfacing events, determining their crater retention ages, and correlating these events over widely separated parts of Mars (2,3,4). It is also possible to determine the minimum extent of now buried surfaces (5,6) and the thickness of the materials associated with the different resurfacing events (6,7).

Such studies have shown a very important resurfacing event on Mars coincident with the emplacement of ridged plains in Lunae Planum and elsewhere (2-7). In this paper we discuss the resurfacing events which dominate the history of the ridged plains and other units in the Coprates region, and determine an average thickness of the ridged plains within the different terrain units in the area.

LUNAE PLANUM AGE (LPA) RESURFACING IN COPRATES

The Coprates region south of the Valles Marineris was subdivided based on terrain morphology into six regions. From west to east these are the relatively smooth plains of Solis Planum (SP), a transition region of subdued ridges (SR), a central region where ridges are prominant but which also contains small grabens (RG), an area of cratered terrain (CT) at 55 to 60 °W, a narrow trough of ridged plains (CR) and an extensive area of old cratered terrain east of 50°W (NPL3). For each of these areas we counted craters larger than 5 km diameter and broke the cumulative frequency curves into branches as described above. For all but the two most western units a strong branch was found with crater retention age N(1)=21,000 to 24,000, associated with the LPA resurfacing (2-4,6,7). The LPA event is not restricted to the ridged plains units (RG,CR) but is seen in the heavily cratered terrains as well (CT,NPL3). In the region of ridges and grabens, a younger branch at N(1)=14,800 appears to be a second episode of ridged plains volcanism, based on the superposition of the craters from this branch on the ridges. If true, then the oldest branch in the curve for SR with N(1)=13,700 is probably a late-finishing resurfacing of the same kind. The lack of such a branch for the Solis Planum area where the oldest surface is N(1)=5000 implies that ridged plains volcanics have been completely buried in this western-most unit.

THICKNESS OF RIDGED PLAINS IN COPRATES

We have shown elsewhere (6,7) that it is possible to derive thickness estimates for the resurfacing materials of any age from the smallest crater which survives from this age surface. Surviving craters actually give the total thickness of all overlying materials; differencing these total estimates for successive resurfacing events allow calculation of the thickness for any event. It is also possible to guess at the thickness or depth to surfaces not seen in the cumulative frequency curve branches. The production curve (1) provides an estimate of the largest (or fifth largest) crater that should be present on any size surface of a given age; the absence of such craters implies that the total overlying thickness is at least the amount of material needed to cover such craters (8). Using such estimates of the thickness of each unit and their ages, it is possible to develop a crude stratigraphy of resurfacing horizons, which we have done for Coprates in Figure 1.

In the eastern units of Coprates craters of moderate diameter show through the ridged plains (CR); these are survivors from before the LPA resurfacing. The lack of such craters in Lunae Planum implies that the thickness of ridged plains and later units is much greater. Our more quantitative estimates based on the smallest survivor bear agree. We estimate in CR that the thickness of ridged plains is about 100m, with an additional 245m of later resurfacing material above. By contrast the thickness of Lunae Planum ridged plains must be about 270m with an additional 315m above. This thickness is much more closely matched by the combined materials from the two episodes of LPA resurfacing in the RG unit, which total to 290m with an additional 225m above. The cratered terrains have very little LPA material; thickness of later materials are roughly the same. Younger resurfacing materials thicken dramatically toward the west through Solis Planum.

When combined with topographic data from ground-based radar, the stratigraphy of these units can be placed in a context which helps explain the variations in thickness. As shown in Figure 2, the great thicknesses of ridged plains materials occurs at the low portion of the downhill slope from Tharsis eastward into Coprates; in the central area the plains have contributed significantly to the height. Eastward the ridged plains thin in the higher-standing cratered terrain, and thicken somewhat in the trough region further east. Information of this sort is particularly useful when correlated with similar resurfacing events elsewhere on Mars (7).

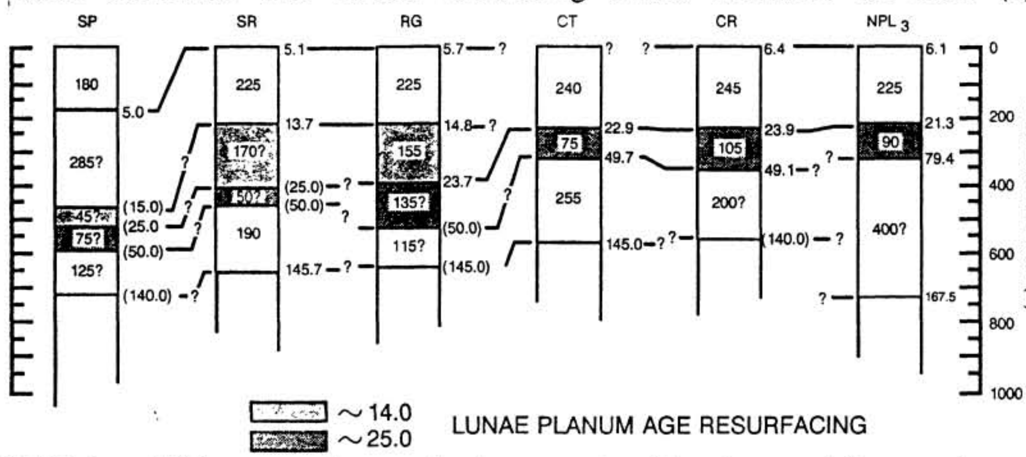
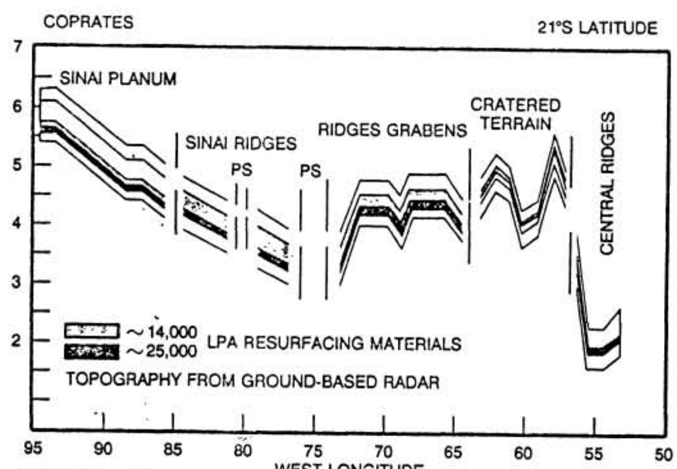


FIGURE 1. N(1) ages of resurfacing events (in thousands) are shown at the sides of each section. Thicknesses shown within each section.



F136 001 FIGURE 2

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