THE RAPID ABLATION ZONE - A DISTINCTIVE TERRAIN UNIT IN
THE MARTIAN NORTH POLAR ICE CAP.
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The rapid ablation zone is a name that can be given to a unit
of distinctive morphology that occurs on the periphery of the
Martian north polar ice cap. It extends from longitude 315° tp 360°.
The zone is roughly triangular in shape with a maximum width of
about 170 km. This width occurs towards the western end and the zone
narrows to the east.

The zone is on the western perimeter of the smaller of the two
domes that constitute the northern ice cap and it forms the most
southerly extension of that cap. It is also the region of the ice
cap with the greatest topographic slope and so, if the ice cap does
deform under gravity, this zone would be the area where the most
rapid horizontal movement would be expected. Computer modelling of
the ice cap has confirmed this expectation. The more southerly
location and high regional slope, both of which would result in
increased insolation, also make this zone the area where the most
rapid ablation of the ice cap would be expected.

The zone forms a region of apparently confused topography with
numerous isolated frost patches separated by curving scarps and
valleys. These scarps and valleys, which exhibit classic "laminated
terrain" morphology, do, however, align to form two sets of
lineations. The first set is aligned at a low angle to the ice cap
edge and is expressed by one major lineation which extends for the
entire length of the zone as well as by a number of smaller
features. The second set lies approximately at right angles to the
first and, consequently, at a high angle to the ice cap edge. This
set is expressed by at least five major lineations which cut all the
way from the inner edge of the zone across to the periphery of the
ice cap, as well as by numerous smaller lineations. These two sets
of lineations form a rectangular grid across the zone. The isolated
frost patches are the remnants, now retreating because of ablation,
of the original intergrid areas.

The development of these scarps and valleys to form this
rectangular grid is considered to be due to preferential ablation
along sets of fractures developed in the ice. This preferential
ablation could be due to increased insolation caused by the
increased slopes along the fracture and a lower albedo due to the
accumulation of dust, as well as to an increase in turbulent heat
transfer caused by the wind blowing across the fracture. The
orientation of the fractures is such that they were probably caused
by the compressive stress, due to gravity, which makes this area the
site of the most rapid horizontal movement of the ice cap.

This system of glacial fractures at the periphery of the
northern ice cap could provide the explanation of the formation of
the feature known as the "Inca City" at the periphery of the
Southern ice cap. If the "Rapid Ablation Zone" were to become stagnant, then the valleys forming the lineations could become filled with sediment. Ablation would eventually cause the intergrid areas to become low lying. This would result in a rectangular grid of ridges such as those which form the "Inca City".

The rapid ablation zone is the site of the unconformity observed by Cutts$^3$ which he considered to be due to climatic change. However, because of the active nature of the area it is more probable that the observed unconformity is due to local warping or overthrusting rather than to any secular change in the Martian climate. Although the zone does contain one concentric circular structure which is apparently a rampart water crater about 2 km in diameter. The preservation of this crater places limits on how active we consider this zone to be.

The wind direction in this zone, as indicated by elongated structures in the ice$^4$, is highly variable. This may result from the deflection of the wind by the irregular topography.

The edge of the ice cap in the rapid ablation zone is sudden and distinct, which indicates that within the response time of the ice cap, the zone has undergone a period of net advance. The edge of most of the northern ice cap is either gradational or a product of erosion; both indicating a net retreat. This is consistent with this zone being the most active area of the Martian north polar ice cap.