

TERRESTRIAL POLAR BEACH PROCESSES: MARTIAN PALEOLAKE ANALOGS; J.W. Rice Jr., Department of Geography, Arizona State University, Tempe, AZ 85287, USA

The perennial ice covered lakes of the Antarctic are considered to be excellent analogs to lakes that once existed on Mars. Field investigations of ice covered lakes, paleolakes, and polar beaches have been conducted in the Bunger Hills Oasis, Eastern Antarctica.

Important distinctions have been made between ice covered and non ice covered bodies of water, in terms of the geomorphic signatures produced. Field investigations have revealed that the classical lacustrine landforms created by non ice covered lakes (spits, bars, berms, cusps, tombolos, and wave cut platforms) are absent in an ice covered lake regime. The features mentioned above are the result of the direct coupling of wind and the free water surface. The ice cover acts as a geomorphically protective agent. Therefore, the shores of ice covered bodies of water are low energy environments i.e. poorly sorted, due to restricted or nonexistent wave action. However, regions of open water may exist for 1-2 months a year, but the proximity of the permanent pack ice severely limits the distance of fetch and consequently the magnitude of wave action. Another curb to any wave action effectiveness is the presence of a narrow strip of ice frozen to the shore which is unaffected by tidal movements. This narrow fringe of ice attached to the shore is an ice foot. It is composed of sea ice, frozen snow, and frozen spray (1). In non tidal regimes, a frozen swash layer with interbedded sediments is termed a kaimoo (2). From a geologic perspective, the ice foot and kaimoo are very important in that they additionally protect the beaches from any limited wave action that may exist. Consequently, Polar beaches are very poorly developed and narrow. These processes (along with age and resolution limits) may help explain why paleoshorelines on Mars are hard to discern.

The most notable landforms produced by ice covered lakes are ice shoved ridges. These features form discrete segmented ramparts of boulders and sediments pushed up along the shores of lakes/seas. The shorelines are generally planated with the ramparts defining the inner edge of the shoreline. These ridges usually have a heterogeneous veneer of boulders, pebbles, sand and gravel mantling an ice core. The ice core normally melts out and leaves behind its mantle of material in the form of irregular discontinuous ridges. The ice core can persist for years if it is sufficiently insulated, by its mantle of material.

The ice shoved features observed in the Bunger Hills Oasis were up to 83m long, 2m high, and 4m wide. Ice shoved ridges up to 300m long and 10m high have been reported (1).

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Other unique landforms associated with polar beaches are frost cracks and mounds, patterned ground, pingos, pitted beaches, coastal striated bedrock, and ventifacts.

References:

- (1) Nichols R. L. (1961) *Am. Jour. Sci.*, 259, 694-708.
- (2) Emberton C. (1975) *Periglacial Geomorphology*, 203p.