



New HRSC Mars Express images of the Elysium frozen sea complex

John B. Murray (1), Matthew R. Balme (1), David Page, Jan-Peter Muller (2), Jung-Rack Kim (2), Jeremy Morley (2), Gerhard Neukum (3) & the HRSC Co-Investigator Team.

(1) Dept. of Earth Sciences, The Open University, Milton Keynes MK7 6AA, U.K. j.b.murray@open.ac.uk (2) Dept. of Geomatic Engineering, University College London, Gower St., London WC1E 6BT, U.K. (3) Geosciences Institute, Freie Universität Berlin, Malteserstr. 74-100, Building D, 12249 Berlin, Germany.

Ten new passes have been made of the frozen sea area of Elysium imaged near the equator of Mars early in the Mars Express mission by the High Resolution Stereo Camera. These new images, taken in August and September 2005, provide complete coverage of much of the western part of the area at resolutions down to 13 metres. Together with THEMIS and MOC NA images, they show an interconnected series of different flooded areas hundreds of kilometres in extent, and the whole complex may be as large as 800 x 2500 km – comparable to the Great Lakes in North America. With a water depth of 50 metres, the total volume of water would have been between 5000 and 75,000 km³. Each sea is connected by a channel system, sometimes dissecting through layered terrain. There are between 4 and 7 layers, suggesting that there may have been several previous episodes of flooding and deposition here. The difference in sea surface level between the different bodies of water is up to 200 metres.

The shorelines of these large bodies of water show different morphologies. In places there are overflow channels cutting the shoreline, leading to depositional areas with raised fronts suggesting mudflows. To the north there are signs that the ice has sublimed away, but in many places on the southern shoreline, the frozen sea surface is overlain by the Medusa Fossae formation. This is of variable thickness, and the presence of yardangs indicates that it is in the process of being eroded away, and inliers of frozen sea surface and pack-ice floes are visible within it. It may be that this deposit has afforded protection to the ice surface against sublimation, and also impact, so that

the age of 5 million years derived from crater counting may be too young.

Within the entire complex, conical mounds, often with irregular depressions at the summit, and sometimes surrounded by moats with an irregular exterior rampart, are concentrated in the channel feeder system rather than the frozen bodies of water. These mounds have been previously interpreted as either pseudocraters in volcanic lava, or ice pingos characteristic of lakes and river deltas in periglacial terrain on Earth. The fact that they are confined to the channel areas indicates that they are ice pingos, as the latter originate in water/ice saturated soils or small shallow lakes such as would remain after the flooding event had taken place. Pseudocraters would be expected to form anywhere where lava has flowed onto water/ice or water/ice saturated ground, including sea and lake shores; and pingos are unlikely to form in areas of thick ice.