THARSIS MONTES SUBGLACIAL VOLCANISM: PROPOSAL FOR A NEW CLASSIFICATION OF THARSIS VOLCANOES BASED ON VOLCANO-ICE INTERACTIONS AND AN ESTIMATE OF THE THARSIS ICE BUDGET. J. Helgason, Ekra Geological Consulting, Thorsgata 24, IS-101 Reykjavik, Iceland**,** e-mail: jhelgason@simnet.is.

An ice sheet has recently been discovered on Arsia Mons, Mars [1] based on morphologic interpretation of Viking Orbiter images. On Arsia Mons a fissure swarm extends from the caldera on the northeast and southwest rim. There, numerous vent-like structures are inter-preted as openings where volcanism has melted ice above an eruptive site. These vents are flat and without a collar of ash. Near each main vent are either several smaller openings down-dip or an open erosional pathway leading into a more increasingly eroded network of gullies that lack graben characteristics.

It is postulated that during each eruption large quantities of meltwater were transported with jökulhlaups into the fan areas, extending up to 1000 km from the caldera rim. The shape of the vent areas and the erosional channels further down dip is an indicator of ice thickness that is assumed to be well over 1 km, reaching a maximum over the caldera lid center.

The ice sheet is regarded a marker horizon within the Tharsis plateau that acted as a high "ice trap". Thus, it covered simultaneously the Tharsis Montes and Olympus Mons as well. Volcanic production in these four volcanoes has, however, varied from the time the marker formed. This has resulted in highly variable morphologic character of these stratovolcanoes where volcanism has gradually interacted with the overlying ice sheet. This is exemplified by various volcano/morphologic features such as: circular vents (melting above craters), canyon formation (jökulhlaup pathways), burial (outwash plain/lava fan), aureole formation (striated features on lower flanks), dead ice deposits (humocky moraines), rimless impact craters into the ice, large scale disintegration of the regolith.

The different volcano/morphologic features lead to a volcano classification from least to most volcanic activity: Arsia $\rightarrow$ Pavonis $\rightarrow$ Ascreous $\rightarrow$ Olympus. It is suggested that all Martian volcanoes can probably be classified on basis of interaction between volcanism and an associated ice sheet.

The process of ice formation associated with the Arsia Mons ice sheet must have been of "Tharsis" extent and reflected a global hydrologic event. The estimated volume of ice associated with this "glaciation" event is a minimum of 5×10^6 km^3, assuming a 0.5 km thick layer of ice that, at the time of formation, was equally distributed above an altitude of 2 km across Tharsis, including Olympus Mons. It is suggested that most of this ice is still buried within the Tharsis regolith and/or forms part of the near surface crustal layer.

References: [1] J. Helgason (1999) *Geology 27*, no. 3, 231-234.