P071-008 Room: C501 Time: May 28 13:30-13:40

Evaluation of melting process of the permafrost on Mars: its implication for surface features

Yoshiko Ogawa[1], Yasuko Yamagishi[2], Kei Kurita[3]

[1] Earth and Planetary Sci., Univ. of Tokyo, [2] IFREE, JAMSTEC, [3] ERI,Univ. of Tokyo

For supplying massive liquid water to the outflow channels, igneous melting of the permafrost layer could have played a significant role. We numerically simulate the melting process of the permafrost layer induced by magmatic intrusion. The point of our simulation is incorporation of thermal convection in porous media, which has not been modeled well in previous studies of the melting of the permafrost. Our results show that convection in the molten zone causes drastic change in heat transfer, which results in focussing in the growth of the melt region and strong enhancement in the water generation. The resulting melt zone extends vertically up just next to the surface, like a plume with single column (mushroom structure). The volume of molten water is several times as much as that expected in the conduction case. These characteristics mean substantial amount of water should exist very near to the surface. We consider compaction should have occurred and segregated liquid water would erupt to the ground to form the fluvial features. The event would certainly accompany surface destruction, which we can see as chaotic terrains. We propose a consistent scenario of forming surface features around the outflow channels.

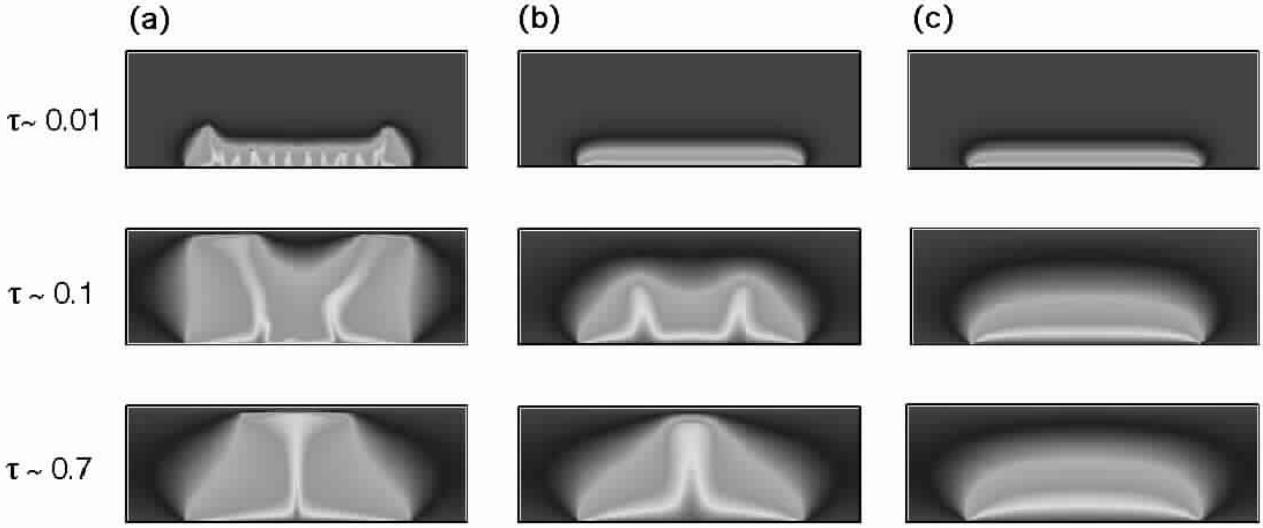

Figure 1. Evolution of temperature field at Ra = (a)100, (b) 700. Other parameters are; Ste = 1.87, ε = 0.2, W = 2H and A = 3 (Ste: Stefan number, ε: porosity, W: width of heterogeneous heating, H: thickness of the permafrost layer, A: aspect ratio). τ is dimensionless time, which is normalized by H^2/α (α: thermal diffusivity of water). The zone which is about a size larger than the bright region corresponds to the molten zone. Three snapshots at each case are illustrated; at the initial stage (τ~0.01), middle stage (τ~0.1) and steady state (τ~0.7). For comparison, temperature fields for the conduction case (c) are also shown. Note particularly significant difference in the morphology of molten zone in the steady state.

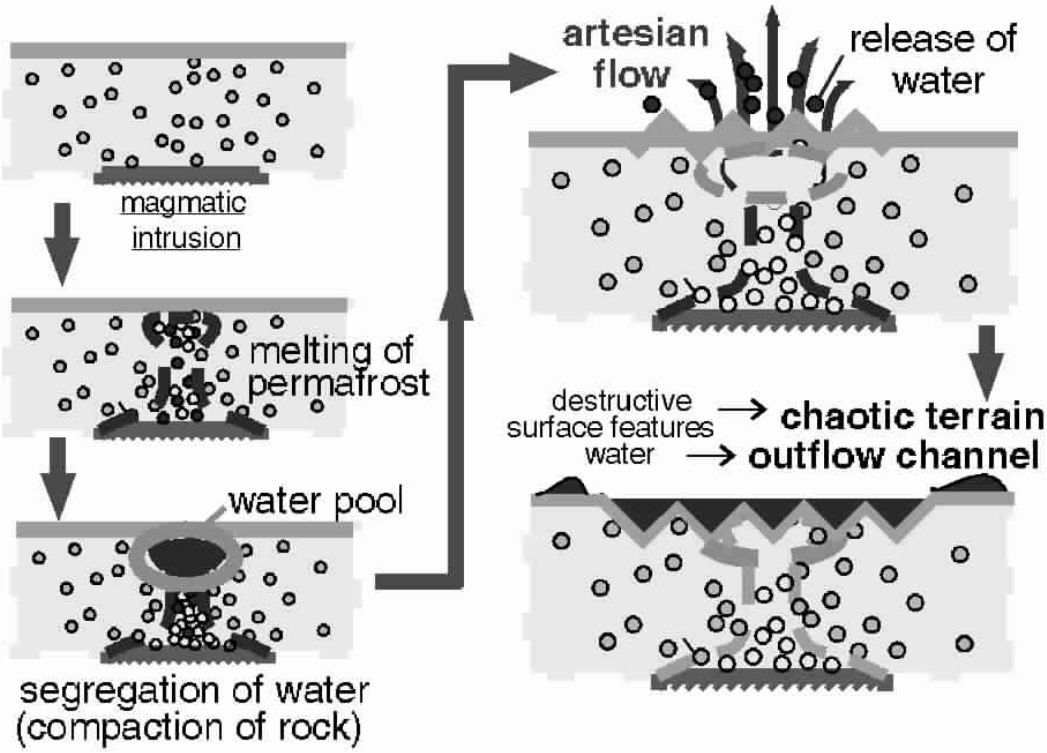

Figure 2. A scenario for formation of surface features; chaotic terrain and outflow channel.