VENUSIAN CHANNEL FORMATION THROUGH SUBSURFACE PROCESSES. N.P. Lang[1] and V.L. Hansen[2], [1,2]Department of Geological Sciences, University of Minnesota Duluth, Duluth, MN 55812; lang0604@tc.umn.edu.

Introduction: Venusian channels contain meanders, braided segments, streamlined islands, and point bars [Baker et al., 1992]. Channels may extend for >200 km [Baker et al., 1992], may or may not contain levees [Bussey et al., 1995; Baker et al., 1997] and sometimes occur in discontinuous segments. Hypotheses regarding venusian channel formation assume channels result from the movement of fluid at the surface [Gregg and Greeley, 1993; Komatsu et al., 1992; Bussey et al., 1995; Williams-Jones et al., 1998; Jones and Pickering, 2003; Lang and Hansen, 2004]; the fluid will form channels through either constructional [Gregg and Greeley, 1993] or erosional [Komatsu et al., 1992; Bussey et al., 1995; Williams-Jones et al., 1998; Jones and Pickering, 2003; Lang and Hansen, 2004] processes. Last year, we [Lang and Hansen, 2004] noted that some channels cut wrinkle ridges and shields and concluded that this relationship suggested thermal erosion of a substrate by fluid at the surface. However, in this abstract, we argue that those observations are inconsistent with channel formation as a surface process. Instead, we argue that our observations [Lang and Hansen, 2004] are more consistent with channel formation as a subsurface process. Subsurface fluid movement may erode the overlying material, or suprastrate. Our hypothesis presented here is similar to the one outlined by Komatsu et al. (2001) for the formation of valley networks; however, our hypothesis does not call upon fluid moving along pre-existing fractures.

Previous channel observations and implications: Last year, we [Lang and Hansen, 2004] observed that:

1) Some channels occur in regions where small shields and their erupted products are abundant. These regions, termed shield terrain (Hansen, 2003), reflect in situ partial melting of a once-upon-a-time hydrated basaltic venusian crust.
2) Some channels cut pre-existing wrinkle ridges and shields with no evidence for channel deflection (Figure 1)

and concluded that channels result from a lava at the surface thermally eroding shield terrain. However, observation 2 is inconsistent with surface erosion. The topographic high should deflect the channel. One would predict a lateral migration of the channel as the channel fluid eroded through the topographic high. There is no evidence of this process occurring at these topographic highs. Further, despite the predicted impeded rate of heat loss for lavas on Venus [Snyder, 2002], lavas would most likely cool before thermally eroding channels >200 km.

New hypothesis for channel formation: Based on the revised implications of our observations, we propose that some channels form as the result of fluid moving in the subsurface and eroding the suprastrate. Erosion of the suprastrate may largely be mechanical, but thermal erosion may also play a role depending upon the properties of the fluid and suprastrate. The occurrence of channels within shield terrain suggests that shield terrain is the eroded suprastrate. It may be that the subsurface fluid flows along the interface between shield terrain and the basaltic crust stoping the overlying shield terrain. Stoping may occur in a piecemeal fashion potentially resulting in a segmented channel sequence such as Ikwhezi Vallis in Llorona Planitia. Continued movement of material through the subsurface conduit may eventually result in the coalescence of exposed segments resulting in a channel.

Discussion: The type of fluid involved in channel formation and its source remain enigmatic. However, given the abundant evidence of volcanism on Venus, the channel forming fluid is likely molten material [e.g. Baker et al., 1992; Komatsu et al., 1992; Gregg and Greeley, 1993]. This idea is consistent with the observation that several channels are associated with magmatic centers [Komatsu et al., 1993]. Some channels though occur in plains regions isolated from magmatic centers. If the channel forming fluid is molten material, then what is its source? Is it possible that the molten material is transported in the subsurface from magmatic centers on other parts of the planet?

The meandering nature of channels suggests that the channel forming fluid does not follow pre-existing structures, as Komatsu et al. (2001) proposes for the formation of valley networks. Instead, the fluid most likely initially forms it own subsurface conduit; however, the driving force behind the formation of this conduit remains purely conjectural. The fluid may move and form a subsurface conduit due to pressure or topographic gradients along the shield terrain-basaltic crust interface.

Our hypothesis is currently purely qualitative and serves as a base from which to build further work. Our hypothesis is unique in that calls upon channel formation as a subsurface process. Subsurface formation of venusian channels may explain the long lengths of some channels. Molten material is able to travel greater distances in the subsurface compared to the surface due to impeded heat loss. However, is heat loss still slow enough to allow the transport of lava for distances >200 km?

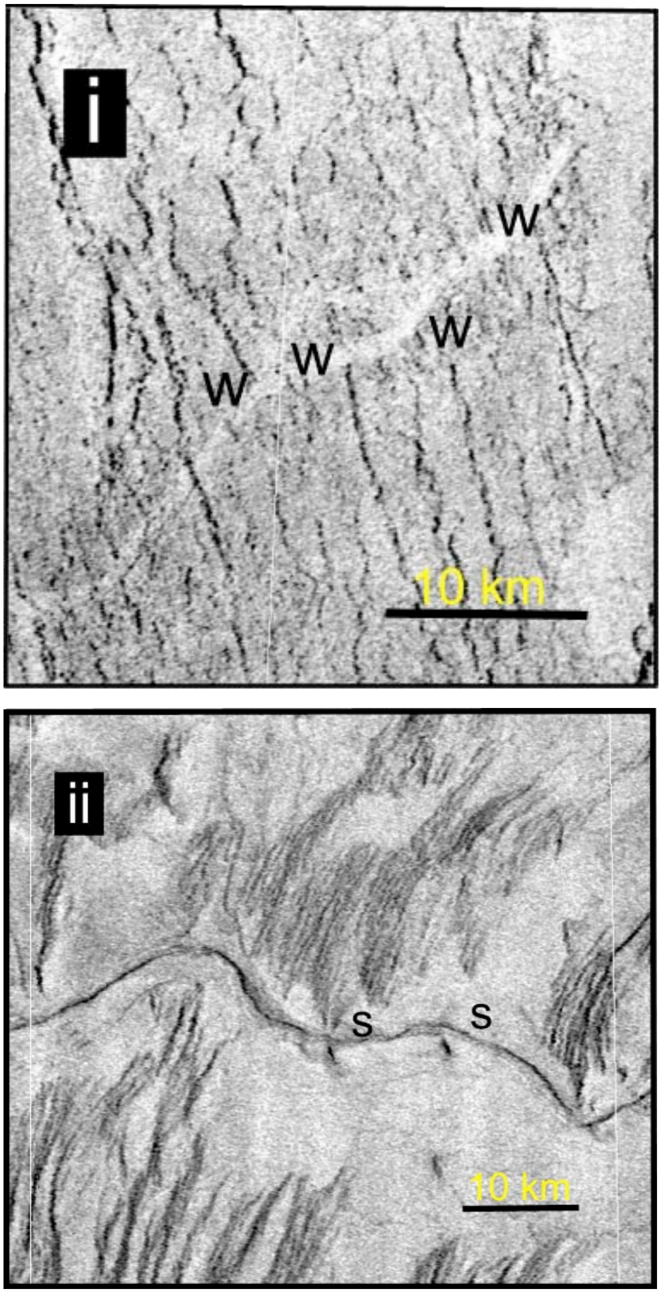

Figure 1: Inverted SAR images of channels cutting pre-existing topographic highs. Note how the topographic high do not appear to deflect the channel i) Sinann Vallis cutting wrinkle ridges (w) (image centered at 48.3^{o} S, 271.6^{o} E). *ii) Lunang Vallis cutting shields (s) (image centered at 68.3 N, 308.5 E).*

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