Locations and Geological Settings of the Venusian Channels.

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Magellan imagery reveals a rich variety of venusian channels. Channels were observed in the Magellan test images. The morphology of channels is described in detail by Gulick et al.[1]. The channels seen to date occur in the following four geological settings:

1. Channels associated with volcanic structures.

1) Coronae: The channels appear inside corona rims (58.3°S, 350° and 67°S, 358°) and show a morphology similar to that of lunar rills (Fig.1). They usually originate at a collapse pit or depression. Some of the channels seem to occur near or on lava flows. Domes of about 1-5km diameter are often seen inside coronae near the channels.

2) Lava delta: The prominent lava delta at 52°-57°S, 351°-357° consists of many radar bright flows (200- 300km long, 10-30km wide). Many of these flows have superimposed channels, which exhibit darker radar response than the flows.

2. Channels occurring in the volcanic plains where volcanic structures are widely distributed.

1) Guinevere Planitia: Five narrow (1-2km wide) and sinuous channels were recognized (in the first 3 days of Magellan images) in the southeastern part (5°S-10°N, 330°- 340°) of Guinevere Planitia, which is basically a volcanic plain (Fig.2). They generally flow east-west and seem to follow the topographic gradient down to the lower elevations of Guinevere Planitia. Some channels are very long (over 1000km) and may originate from the Hengo Corona (center 2°N, 355°, 900 km diameter). In addition to the well-defined channels, there are many "ghost" or relict channels which seem to be buried by mantling materials.

2) Lakshmi Planum: Typical lava drainage channels (length 50-100km, width 1-2km) enamate from the Danu Montes and terminate in the Lakshmi Planum. Their depressional sources are located in the Danu Montes. These channel sources seem to be related to the extensional tectonics evidenced by the chains of pits in the surrounding range of the Lakshmi Planum.

3) Bereghinya Planitia: West of a major linear deformation zone (45°-48°N, 19°-23°) and circular features (45°N, 18° and 45.5°N, 19°), a few large channels are located. The largest (over 400km long) shows a distributary system at its end. The sources of these channels are difficult to determine, but the responsible flows may enamate from the above mentioned circular features. In this area, relatively small (<100km long) channels are seen with depressions as sources.

4) Northern Lada Terra: There is a huge channel system (46°- 53°S, 19°-32°) which has a similar configuration to the Martian outflow channels [2]. This channel system is described in detail by Parker et al [3]. It has collapsed sources and a relatively straight segment in its upchannel reaches. In its middle reaches, this "outflow channel" is anastomosing and branching. It widens markedly in a reach characterized by streamlined islands. The system terminates in a distributary pattern with levee development. The transported materials comprise a great terminal pond of radar bright response on the imagery. The entire length of this channel system is over 1000km and the widest part of the channel is about 15km. In addition to this large channel system, there are many smaller channels with deposit levees at their ends. These channels are related to a possible corona source area.

3. Channels occurring in the mountain range of tectonic origin.

1) Freyja Montes: One relatively wide channel (max 7km, average less than 2km, at least 500km long) flows from east to west in Vires-akk Chasma and apparently deposits its fluidized materials in the basin bounded by the Freyja Montes and Uorsar Rupes. This channel's mid-stream sinuosity seems to be controlled by the tectonic structures. The source of this channel is not yet clear.

2) Western Lada Terra: Western Lada Terra consists of alternating mountain ranges (10-100km wide) and flat basins (1-50km wide). Many lava channels extend from the mountain ranges to adjacent basins, where they terminate (Fig.3). Some of them show levees at their terminus. The mountain ranges of the western Lada Terra seem to be degraded compared with typical tessera, suggested by the higher sinuosity of ridges. The flat basins seem to be result of the embaying material possibly carried in by the channels and also by lava flows from Quetzalpetlatl Corona. Some channels' source is this Quetzalpetlatl Corona south west of western Lada Terra.

4. Channels associated with impact/or impact related features.

1) Fluidized ejecta blanket: Three large craters (30-65km in diameter) at 25°-29°S, 336°-341° have fluidized ejecta blankets (FEBs) and sinuous channels exist on the FEBs. FEBs enamate from the bright blocky ejecta blankets. Some of the channels have streamlined islands in their mid-stream. Hypotheses for the origin of FEBs and FEB-channels are presented by Komatsu et al [4].

2) Cleopatra: This 110km diameter crater hypothesized to be of impact origin on the eastern flank of the Maxwell Montes exhibits a channel enamating from inside its central ring, draining out toward the east (Fig.4). Transported materials seem to embay ridges. This is the highest altitude channel located thus far.

Geologic Settings of the Venusian Channels: Komatsu, G. et al.

Venusian channels occur in a variety of geological settings. They are seen from the lowlands (-1km - 1km) to high mountain ranges (7000-8000m), in the fluidized ejecta blankets of impact craters and in the vast lava delta. Clear association of the channels with volcanic constructs along with common lava levee formation exclude fluvial process as an origin for many channels. The extreme temperatures of impact and atmosphere also make an aqueous origin unlikely. However, a variety of geological settings suggest that the favorable conditions for the channel formation are prevalent on the venusian surface. The primary control is probably the high surface temperature. This would reduce the cooling rate significantly for time scales longer than an hour [5]. Low viscosity lava with high effusion rates, as suggested by the low shield volcanoes [6], is preferable for the channel formation. These conditions have to be satisfied even in the case which is induced by the impact process or in the terrain where the tectonics seems to be dominant. However the close resemblance of the some of the venusian channels to the terrestrial fluvial systems may not be fully explained by even the combination of high surface temperature, high effusion rate and low viscosity silicate lava. Involvement of low melting-temperature material may be required [7]. The fact that many channels originate or occur in the vicinity of coronae implies that coronae may be the surface expression of major conduits and/or generators of the low viscosity magmas derived from the mantle.

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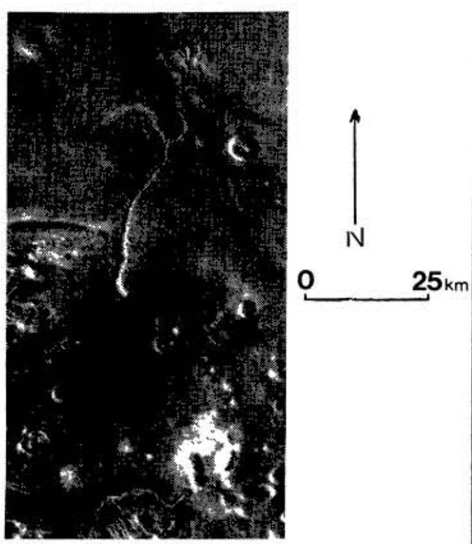

Figure 1. Channels in the corona.
(58.5°S lat., 350° lon.)

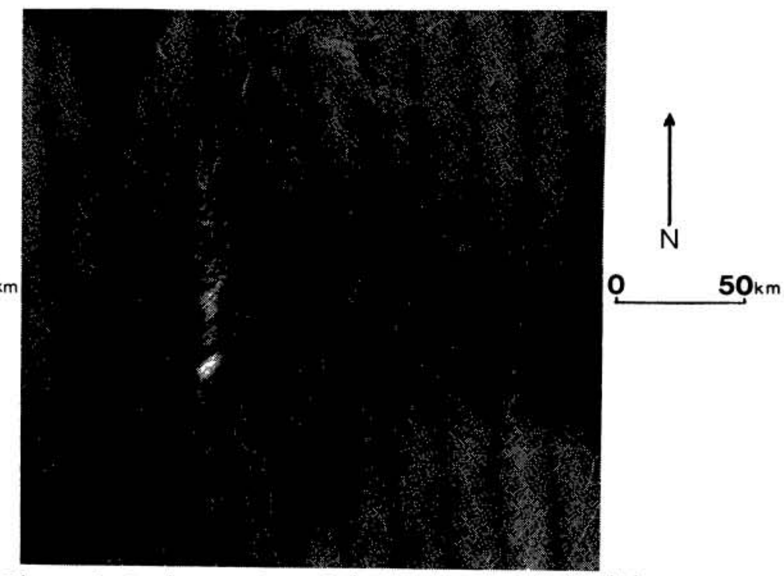

Figure 2. A sinuous channel in the Guenevera Planitia.
(3°N lat., 335°lon.)

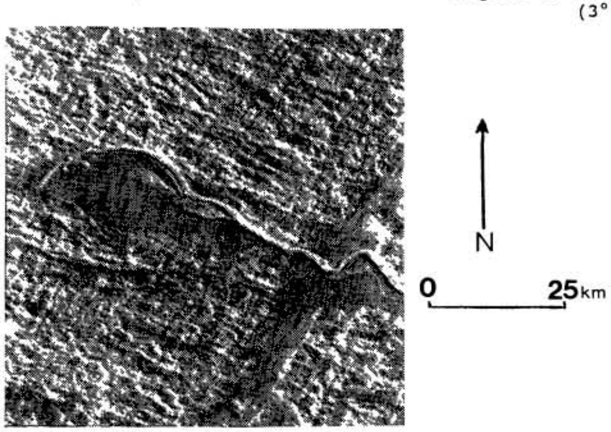

Figure 3. A channel in the Lada Terra.
(66°S lat., 14°lon.)

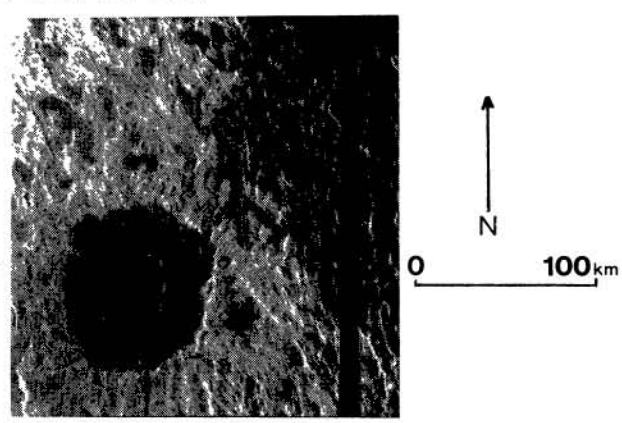

Figure 4. Cleopatra and a channel draining out.
(67°N lat., 6°lon.)