N93-14336

VENUS INTERNAL MAGNETIC FIELD AND ITS INTERACTION WITH THE INTERPLANETARY MAGNETIC FIELD.

W. C. Knudsen, Knudsen Geophysical Research Inc., Monte Sereno CA 95030, USA.

In a previous study, Knudsen et al. suggested that Venus has a weak internal magnetic dipole field of the order of $7 \times 10 + 20\ \mathrm{G\ cm^{-3}}$ that is manifested in the form of magnetic flux tubes threading the ionospheric holes in the Venus nightside ionosphere [1]. They pointed out that any internal field of Venus, dipole or multipole, would be weakened in the subsolar region and concentrated in the antisolar region of the planet by the supersonic transterminator convection of the dayside ionosphere into the nightside hemisphere. The inferred magnitude of the dipole field does not violate the upper limit for an internal magnetic field established by the Pioneer Venus magnetometer experiment [2]. The most compelling objection to the model suggested by Knudsen et al. has been the fact that it does not explain the observed interplanetary magnetic field (IMF) control of the polarity of the ionospheric hole flux tubes [3,4]. In this presentation I suggest that a magnetic reconnection process analogous to that occurring at Earth is occurring at Venus between the IMF and a weak internal dipole field. At Venus in the subsolar region, the reconnection occurs within the ionosphere. At Earth it occurs at the magnetopause. Reconnection will occur only when the IMF has an appropriate orientation relative to that of the weak internal field. Thus, reconnection provides a process for the IMF to control the flux tube polarity. The reconnection in the subsolar region takes place in the ionosphere as the barrier magnetic field is transported downward into the lower ionosphere by downward convection of ionospheric plasma and approaches the oppositely directed internal magnetic field that is diffusing upward. The reconnected flux tubes are then transported anti-Sunward by the anti-Sunward convecting ionospheric plasma as well as by the anti-Sunward-flowing solar wind. Reconnection will also occur in the Venus magnetic tail region, somewhat analogously to the reconnection that occurs in the magnetotail of the Earth.

The possibility that reconnection is occurring between the IMF and an internal dipole field may be tested by measuring the orientation of the IMF projected into a plane perpendicular to the solar wind velocity during time intervals for which ionospheric holes are observed. The orientations of the IMF components should fall within a 180° angle.

References: [1] Knudsen W. C. et al. (1982) *GRL*, 765–768. [2] Russell C. T. et al. (1980) *JGR*, 8319–8332. [3] Luhmann J. G. and Russell C. T. (1983) *GRL*, 409–411. [4] Marubashi K. et al. (1985) *JGR, 90*, 1385–1398.

N93-14337

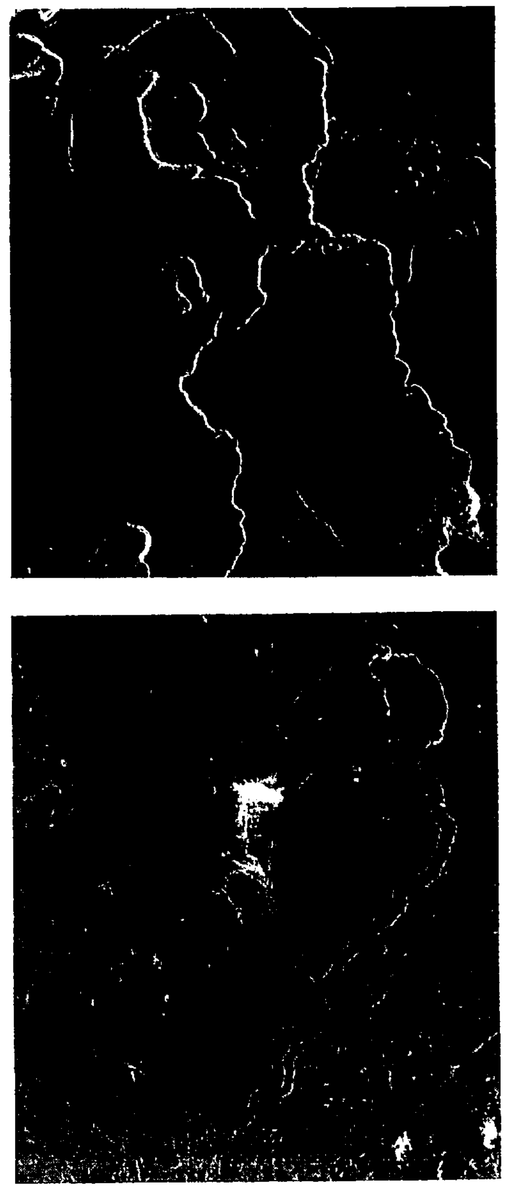
VENUSIAN SINUOUS RILLES.

G. Komatsu and V. R. Baker, Lunar and Planetary Laboratory, University of Arizona, Tucson AZ 85721, USA.

After a preliminary assessment of venusian channels [1], it now seems to be clear that the channels have distinctive classes, which imply a wide range of formation parameters and formation mechanisms [2]. They include outflow channels mainly formed by mechanical erosion from very high discharge flow [3], and canali-type channels requiring either constructional process or mechanical erosion by rather exotic low-viscosity lava such as carbonatite or sulfur [4]. Here we focus on venusian sinuous rilles.

Morphology: Venusian sinuous rilles are generally simple, and originate from a collapsed source. They are shallow and narrow downstream. The venusian sinuous rilles are distinct from canali-type channels, which exhibit almost constant morphologies throughout their entire length, and from outflow channels, which are characterized by wide anastomosing reaches. Venusian sinuous rilles are very similar to many lunar sinuous rilles in their morphologies [1] and even dimensions.

Hypothesized Origins: *Thermal erosion.* The close similarities of venusian sinous rilles to lunar sinuous rilles imply a similar formation by flowing lava. Many mechanisms of lunar sinuous rille formation have been proposed by various workers. Thermal erosion was argued to be a major process for their formation [5]. The lunar sinuous rilles could have been formed initially as constructional



Figs. 1 and 2. Venusian sinuous rilles have morphologies similar to lunar sinuous rilles. The channels have collapsed pits, and shallow and narrow downstream. These morphologies indicate loss of thermal erosion capacity as the lava cools.

Fig. 3. Some venusian sinuous rilles are associated with coronae. Corona volcanism may have provided required conditions for the sinuous rille formation (high discharge, high temperature, low viscosity, etc.).

channels. However, incision was caused by the long flow duration and high temperatures of eruption, along with relatively large discharge rates, possibly assisted by a low viscosity of the channel-forming lava. Channel narrowing and levee formation suggest relatively fast cooling. The venusian channels could have had a similar sequence of formation including rapid cooling.

Lava types. Assuming the substrate is typical tholeiitic lava, the flowing lavas' temperatures have to be higher than the melting temperature of the substrate. The flow should have a low viscosity to cause turbulence and keep a high Raynolds number to sustain efficient thermal erosion. The returned Apollo samples indicate that the lunar lava was enriched in Fe and Ti and had relatively low viscosities and high eruption temperatures [6]. Venera landers reported tholeiitic basalt and alkaline basalt for the composition of plains material. However, none of the landers landed close to venusian sinuous rilles. So the chemical composition of sinuous rille-forming lava remains uncertain. A potential clue comes from geologic associations. The channels are often associated with the coronae [7], which are hypothesized to be related to mantle plume activity. The channel-forming lava may be mantle-derived magmas, e.g., alkaline basalt, picrite, komatiite [2]. They have low viscosities at their melting temperatures, and, since the eruption temperature of these lavas is so high, thermal erosion can be very efficient. Some of the channels' great depths (approximately a few hundred meters deep) may thereby be explained. Because high-temperature lava tends to cool rapidly, the channel narrows, shallows, and terminates over a relatively short distance.

Eruption Conditions: Determining eruption conditions also provides insights to estimate lava composition. Assuming a channel is formed mostly by thermal erosion, the channel's length and longitudinal profile are functions of lava properties. The depth profiles of the channels are measured by radar foreshortening methods and stereo images. Eruption conditions of channel forming lava can be estimated by the methods developed by Hulme [5].

References: [1] Baker V. R. et al. (1992) *JGR*, in press. [2] Komatsu G. and Baker V. R. (1992) *LPSC XXIII*, 715–716. [3] Komatsu G. and Baker V. R. (1992) *LPSC XXIII*, 713–714. [4] Komatsu G. et al. (1992) *GRL*, in press. [5] Hulme G. (1973) *Mod. Geol.*, *4*, 107–117. [6] Murase T. and McBirney A. R. (1970) *Science*, *167*, 1491–1493. [7] Komatsu G. et al. (1992) *LPSC XXIII*, 717–718.

N93-14338

RADIATION PRESSURE: A POSSIBLE CAUSE FOR THE SUPERROTATION OF THE VENUSIAN ATMOSPHERE.

J. L. Krause, Hibbing Community College, Hibbing MN 55746, USA.

The superrotation of the venusian atmosphere relative to the planet's surface has long been known. Yet the process by which this vigorous circulation is maintained is poorly understood [1]. The purpose of this report is to show that a mechanism by which the solar radiation interacts with the cloudy atmosphere of Venus could be the principle cause of the superrotation. Radiation pressure is the term used to describe the result of the transfer of momentum from a photon to matter that occurs when a photon interacts with matter by the known processes of absorption, scattering, or reflection.

The simple rotor radiometer (Fig. 1) can be used to demonstrate radiation pressure. It is useful to review this classic demonstration as the proposed mechanism is so closely related to it. It is known that the absorbing surface of the asymmetrical rotor begins to turn toward the radiation when a radiation source is placed before the apparatus. A specific configuration of this system (Fig. 2) aids in the explanation of this rotation. The radiation interacts differently with the different vane surfaces. When a photon strikes the absorbing surface and is absorbed, its momentum is transferred to the vane. When a photon strikes the reflecting surface of the opposite vane, its momentum is transferred to the vane twice in the reflection process.

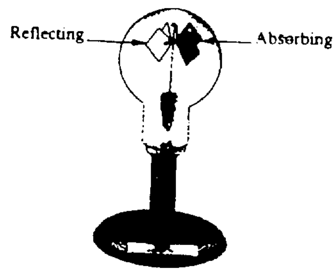


Fig. 1.

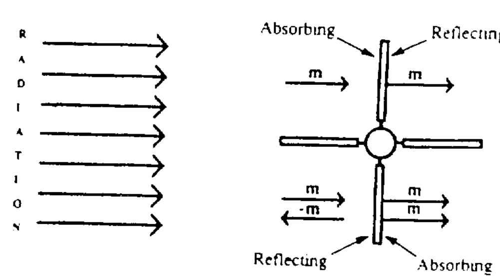


Fig. 2.