

A NOTE ON VENUS TRANSIT AND MICROBIAL INJECTION TO EARTH

N. Chandra Wickramasinghe and Janaki T. Wickramasinghe

Buckingham Centre for Astrobiology, The University of Buckingham, Buckingham MK18 1EG, UK

Abstract

The Venus transit on June 2012 offered the best chance in perhaps a century for the direct transfer of microorganisms from the clouds of Venus to Earth. The transfer process, discussed earlier by us, involves the solar wind and radiation pressure transport of charged dust from the atmosphere of Venus to the Earth. In this note we summarise our earlier arguments as they relate to the most recent transit.

While conditions near the surface of Venus ($T > 460^{\circ}\text{C}$) rule out microbial life, the temperature and pressure regime prevailing in the altitude range 70–45 km in the atmosphere defines a “habitable zone” for some types of extremophilic bacteria that are actually found on the Earth. The ambient temperature in this region varies between -25°C and $+75^{\circ}\text{C}$, and the pressure in the range ~ 0.1 to 10 bar. Speculations relating to Venus-adapted microorganisms have been discussed over many years (Morowitz and Sagan 1967; Cockell 1999; Hoyle and Wickramasinghe 1981; Schulze-Makuch et al. 2004).

Water, albeit in small quantities, has been identified in the atmosphere, adequate for microorganisms to concentrate and exploit. The presence of H_2S and SO_2 in the atmosphere is consistent with the presence of extremophilic “sulphur” bacteria (Cockell 1999); and droplets of atmospheric sulphuric acid could provide a medium in which acidophiles (acid loving bacteria) can thrive. Furthermore, with a stable cloud system circulating between ~ 70 and 45 km, and a steady supply of nutrients from sublimating meteorites, a Venusian aerobiology remains a distinct possibility (Hoyle and Wickramasinghe 1981, 1982). The microbiological as well as chemical and spectroscopic arguments favouring this possibility have been comprehensively reviewed earlier (Wickramasinghe and Wickramasinghe, 2008) and will not be repeated here.

In this note we summarise our earlier arguments concerning transfers of such microorganisms to Earth during transits of Venus as happened last in 2004 and 2012. Such pairs of closely spaced transits are separated by time intervals exceeding ~ 100 years, the next transit being due in 2117.

The lining up of the Sun, Venus and Earth and the relative proximity of Venus to Earth offers an easy route for microbes, provided suitable mechanisms exist for lofting cloud particles to high enough altitudes in the atmosphere for them to become entrapped in the solar wind. The schematic transfer path of particles from Venus to Earth during a transit is sketched in Fig. 1; transfer takes place as the plume of outflowing material crosses the Earth.

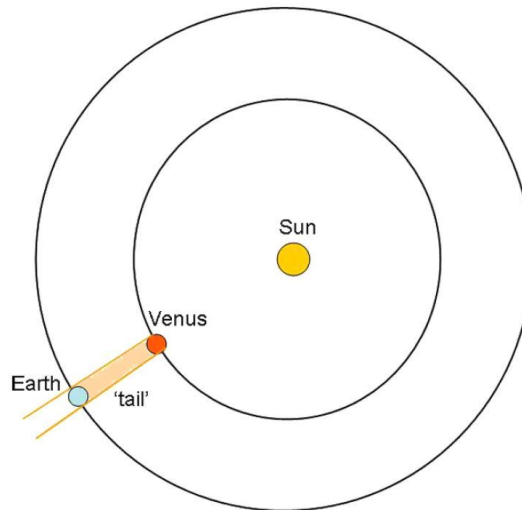


Fig. 1 Schematic route of transfer of material from Venus to Earth during a planetary transit event. The tube of material reaching Earth is ~ 840 km wide, and charged dust and ions in the tube enter the Earth's magnetosphere during the crossing time.

Figure 2 shows how the solar wind excavates the atmosphere of Venus causing a wake directed in the antisolar direction (Russell et al, 1983; Svendhe et al, 2007). A simulation of this effect, based on Venus Express data, is available on the ESA website (http://www.esa.int/esaSC/SEMMAGK26DF_index_0.html). In such an outflow charged particles (ions, dust, bacteria, perhaps viruses) that are convectively lofted to the planet's exosphere, can be easily driven outward by radiation pressure (ESA Venus Express Data, 2008). Such particles are then "trapped" in the solar wind and can eventually reach the Earth's orbit.

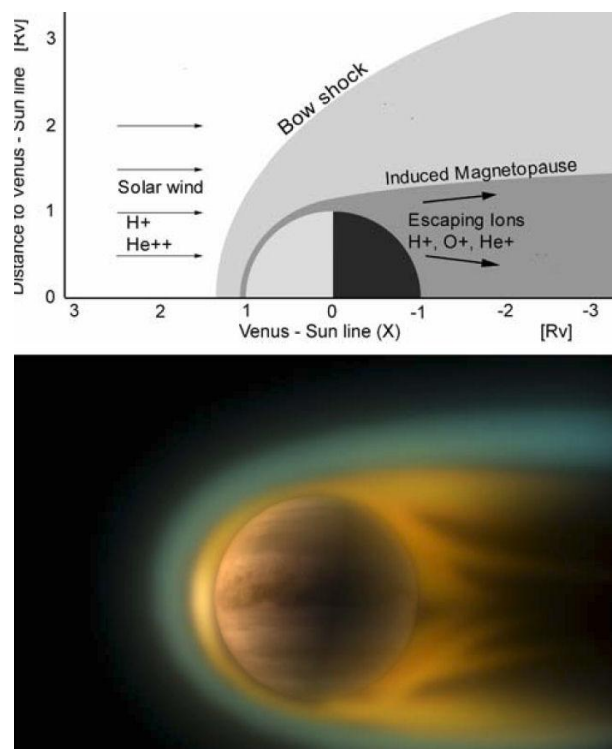


Fig.2 Evidence of solar wind excavating the atmosphere of Venus (Courtesy ESA; Simulation at: http://www.esa.int/esaSC/SEMMAGK26DF_index_0.html; ESA Venus Express Data (2008); Svedhem et al. (2007))

Outside the period of any transit event the total outflow rate of charged particles, including O^+ , H_2O^+ , C^+ , reaching the Earth's distance was estimated at $\sim 3000 \text{ ions cm}^{-2}\text{s}^{-1}$, on the basis of space measurements made on June 10, 1996 (Grunwaldt et al, 1997; Wickramasinghe and Wickramasinghe, 2004). Since these measurements were carried out at a time when the sunspot number was at a record low, and since the recent transit occurred near sunspot maximum, our original estimate of the total mass intercepted by the Earth's magnetosphere as it swept by would need to be increased significantly, say, by the ratio of sunspot numbers in June 2012 to that in June 1996. Thus we could justify a revision of our original estimate of the mass of ions from Venus reaching the Earth during the transit to several hundred grammes. With $\sim 1\%$ of this in the form of biomaterial we might expect a few grammes of bacteria and viruses to have reached the Earth on 5 June 2012. This may seem small, but noting that a bacterium weighs some 10^{-12} grammes, we would have about 10^{12} Venusian bacteria, and possibly $10^{18} - 10^{18}$ Venusian viruses as well, in our midst.

Charged bacteria and viruses entering the Earth's magnetosphere would initially follow magnetic field lines, and their quickest and most direct descent will be near the poles. At other latitudes diffusion across field lines and descent to ground level will depend on the particle size as well as prevailing meteorological factors and could take from days to months. Venusian microbes will eventually be included as nuclei of rain drops and mist and be added to the Earth's biosphere.

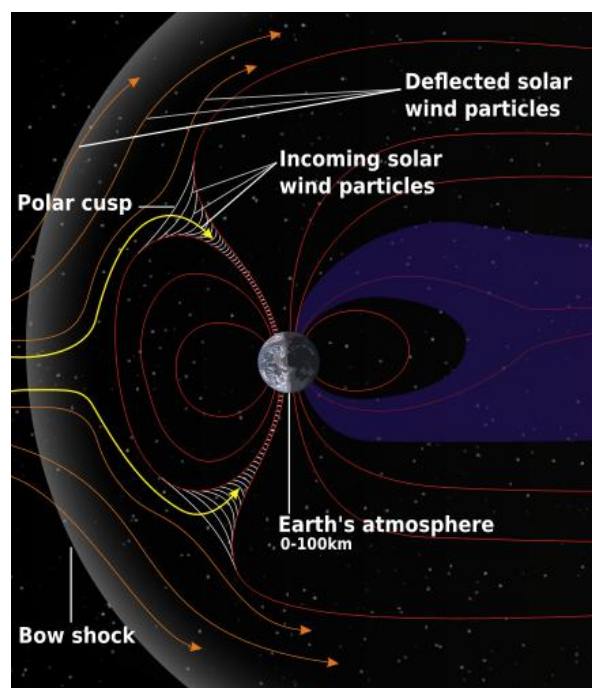


Fig. 3 Schematic picture of Earth's magnetosphere. Charged particles from Venus would descend most quickly into the polar regions, following magnetic field lines.

If they are able to replicate in the Earth's biosphere, they would certainly have contributed - albeit modestly - to our planet's genetic heritage. Venus – the goddess of love - may then be said to have impregnated Earth with alien genes, as indeed she would have been doing for countless ages in the past.

References

- Cockell, C.S.: *Planet. Space Sci.* **47**, 1487 (1999)
- ESA Venus Express Data (2008). http://www.esa.int/esaMI/Venus_Express/index.html
- Grunwaldt, H., et al.: *Geophys. Res. Lett.* **24**, 1163 (1997)
- Hoyle, F., Wickramasinghe, N.C.: *Space Travellers. The Bringers of Life*. University College Cardiff Press, Cardiff (1981)
- Hoyle, F., Wickramasinghe, N.C.: *Proofs that Life is Cosmic. Mem. Inst. Fundamental Studies*, No.1, Sri Lanka (1982)
- Knollenberg, R.G., Hunten, D.M.: *Science* **203**, 792 (1979)
- Morowitz, H., Sagan, C.: *Nature* **215**, 1259 (1967)
- Russell, C.T., Vaisberg, O.: In: Hunten, D.M., et al. (eds.) *Venus*, pp. 873–940. University of Arizona Press, Arizona (1983)
- Schulze-Makuch, D.H., et al.: *Astrobiology* **4**, 11 (2004)
- Svedhem, H., Titov, D.V., Taylor, F.W., Witasse, O.: *Nature* **450**, 629 (2007)
- Wickramasinghe, N.C. and Wickramasinghe, J.T., *Astrophys.Sp.Sci.*, **317**, 133 (2008)