An Alternate View of Venus
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Abstract

Overwhelming physical evidence *has been present for twenty-five years* that Venus is a hot new planet, which we maintain resulted from the high velocity impact (> 10^{43} ergs) on Jupiter about 6,000 years ago. Up-welling radiation measurements from five independent Pioneer Venus probes all agree that Venus is radiating 250 times more energy than the Earth. The interior is completely molten with a tenuous crust less than a kilometer thick floating on top. Venus' enormous internal heat is manifested by raw lava lying in myriads of cracks on the surface and the high velocity jetting of sulfur gases (primarily S_8) from some two hundred thousand 'small domes,' to an altitude of 48 km. The S_8 molecule, the stable form of sulfur at temperatures in the lower atmosphere, was not detected because its mass was beyond the range of the Pioneer Venus instruments. The surface temperature is maintained at 450 C by the evaporation of raining sulfur. The altitude of the ubiquitous lower cloud layer corresponds to the exact temperatures at which the rising S_8 freezes to form monoclinic and rhombic crystals, which comprise it. It is the great mass of sulfur suspended in the lower atmosphere (Hadesphere) which produces the high surface pressure, not CO_2. CS also crystalizes from the rising gases at 31 km and catalyzes reactions which capture carbon. This caused the dropout of CO_2 and CO between 31 and 50 km, currently attributed to 'a clogging of the mass spectrometer input leak(s).' We maintain that the dominant gas in the lower atmosphere is S_8, not CO_2, and there is no 'runaway greenhouse effect.' The great mass of upward jetting gases is what drives the 'four day' zonal winds which encircle the planet at all latitudes, for which there is currently no viable hypothesis.

Background

The currently accepted paradigm assumes that the terrestrial planets accreted from refractory particles in the inner solar system some 4.7 billion years ago. Adherence to this hypothesis results in a failure to explain almost every unique aspect of the planet Venus, among them: the slow retrograde rotation; the near resonant spin-orbit coupling with earth; the high, uniform surface temperature and pressure; the super-rotation of its atmosphere; the surplus energy which it radiates; its lack of a magnetic field; the totally volcanic surface; the uniform planet-wide cloud and haze layers; the illumination level at the surface; the high deuterium to hydrogen ratio; and the near-total malfunction of the sensor systems on all the Pioneer Venus probes as they descended through altitudes of 12 to 14 kilometers. Our scenario provides answers to all of these difficulties and eliminates the rejection of large amounts of the Pioneer Venus data which project scientists found necessary in order to retain the current paradigm.

The Proposed Scenario

Based on our interpretation of sacred myths of a number of cultures and archaeological data, Venus was born some six millennia ago when a 'traveler', from outside the solar system, collided with Jupiter releasing more than 10^{43} ergs (*1*). The site of this impact is the source of the Great Red Spot, still visible to this day. The material which rebounded from Jupiter, from which proto-Venus formed, comprised all the elements in their 'natural' proportions on Jupiter, except for a small portion contributed by the extra-solar-system body. The initial mass of vaporized material which rebounded into space formed an enormous, glowing plasma cloud so large that it was not only seen on Earth, but its elephantine shape was described in the Rig Veda. It must have been a thousand times the volume of Jupiter itself. This event was heralded by world-wide disturbances of the Earth, due either to tidal forces as the invisible body passed the earth just prior to its impact or gravitational waves emitted as a result of the impact.

Fortunately, Nature has recently provided us with a number of similar events, albeit of much lower energy, when the fragments of the comet Shoemaker-Levy 9 struck Jupiter. This was a low energy example of the enormous impact 6,000 years ago, which we call the *Little Bang*, out of which proto-Venus was born. S-L 9 did more than show the results of a single impact. It demonstrated that the impacts of the more massive bodies resulted in different phenomena, that is, *earth-sized atmospheric plumes which emitted the spectral signatures of a number of heavy elements never before observed on Jupiter*. The implication of the S-L 9 impacts is that the more massive fragments penetrated the atmosphere and struck the *solid snow/ice surface of Jupiter*, in which are imbedded refractory grains of all the heavy elements required to produce a terrestrial planet. The six minute delay in the appearance of the plumes was the time required for the great mushroom clouds to rise from the surface to the cloud tops.

In the case of the *Little Bang*, an enormous plasma cloud rebounded with sufficient velocity to escape the gravitational field of Jupiter and entered an orbit around the Sun. As with the earth-sized plumes dredged up by the S-L 9 fragments, this cloud comprised a large concentration of heavy elements. It was these elements that contracted, due to their mutual gravitational attraction, to form proto-Venus. In the first few months of its gravitational contraction the cloud became a seething ball of incandescent plasma at temperatures greater than 10,000 Kelvins. In conventional thinking, the heating of a terrestrial planet to such a high temperature is incomprehensible. The intuitive reaction is that the planet would have been 'destroyed.' In one sense this is true, because not a single molecule currently part of Venus was intact previously on the surface of Jupiter. The energy of that colossal impact completely tore apart all molecular bonds and ionized most of the atoms. Thus Venus formed from a virgin *atomic plasma cloud*, and not the molecular species characteristic of Jupiter's surface.

Although this plasma cloud appeared as a star as it contracted gravitationally, it was different from a true proto-star in several aspects: Its original mass was much less, perhaps 10 times the current mass of Venus; its initial radius was at least ten times that of Jupiter; its temperature rose quickly above 10,000 Kelvins, therefore it was completely ionized; and it comprised a large concentration of heavy elements previously trapped in the primordial ices that comprise the bulk of Jupiter. In this state it quickly reached quasi-hydrostatic equilibrium as the kinetic energy released in contraction was balanced by the radiation pressure.

Several years later, when it had begun to cool down, proto-Venus made its first perihelion passage. Enormously powerful mechanisms then began the process of reducing the eccentricity of its orbit. Its orbital energy was rapidly dissipated by braking forces exerted on it by the Sun. Unlike the small distortions of the rigid lithosphere of the Earth due to the tidal force of the Moon and the frictional tidal forces, which act on the very thin layer of water on the surface, the tidal force exerted by the Sun on proto-Venus greatly distorted its shape and caused the interior to seethe and once again increase its temperature. Moreover, due the high state of ionization, *electromagnetic drag* came into play, due to the solar magnetic field. Together these effects dissipated its orbital energy orders of magnitude faster than would be the case with a rigid body.

These effects were repeated at each perihelion passage, reheating the proto-planet again and again to temperatures in excess of 10,000 Kelvins (2), initially at five year intervals but decreasing to less than one year intervals, as its eccentricity was rapidly reduced.

The High Density of Venus

The high temperature cycling induced by these repeated encounters served a very important function. It preferentially drove off more and more of the light elements, eventually increasing the average density of proto-Venus from about 1 g/cm^3, characteristic of the material ejected from the surface of Jupiter, toward that of a terrestrial planet, around 5 g/cm^3. The out-gassing continued at a diminishing rate for almost four millennia as evidenced by descriptions of Venus as a 'bearded star' in the first millennium BC. However, the mechanisms of such losses changed as the proto-planet began to form a tenuous crust.

Insight into the question of whether the initial cloud would be bound can perhaps be gained in terms of Jeans, or thermal, escape. Sir James Jeans determined several theoretical limits intended to define the conditions under which a concentration of gases in space could contract to form a proto-star. The gas cloud, usually assumed to be hydrogen, must be larger than the Jeans radius, R_J, in order to be bound, that is, to have the potential to contract into a proto-star. It is given by:

$$R_J = \sqrt{\pi kT / m_H G \rho_0}$$

where k is the Boltzmann constant, T the temperature, m_H is the mass of the hydrogen atom, G the universal gravitational constant and ρ_0, the density of the gas cloud. The initial cloud proposed here is far from the conditions assumed by Jeans, but we can perhaps obtain some information about the reasonableness of our estimated values. Assuming an initial temperature of 1,000 kelvins, a radius 10 times that of Jupiter (7×10^5 km) and a mass 10 times Venus' current mass (4.87×10^{25} kg), giving a density of 3.5×10^{-5} g/cm^3, we obtain an R_J of 3.3×10^6 km. Because the assumed radius of the cloud is smaller than the calculated Jeans radius, the implication is that the hydrogen and other light elements will not be bound. But the Jeans radius obtained by substituting masses of elements greater than, say $20 \times m_H$, out of which the solid planet Venus formed, are smaller than the assumed radius, implying these elements would be bound.

The out-gassed material escaped the intense heat of the proto-planet, condensed, reacted to form molecules and crystallized into tiny solid particles in empty space, forming two dark columns (neutral and singly ionized), hundreds of millions of kilometers long. They were dense and therefore appeared black, in contrast with the familiar white or bluish 'tails' formed by comets due to the out-gassing and freezing of ices in space (3).

Interestingly, this process of catastrophic terrestrial planet formation allows for the subsequent sweeping up of much of the volatile material initially lost into interplanetary space, either by the new planet when it cools or by extant ones. *In this process the acquisition of the aenosphere is not so dependent on the impacts of millions of comets from the far reaches of the solar system.*

We claim that this scenario not only reveals the process by which Venus was formed, it describes the mechanism whereby all terrestrial bodies were formed. Not by gradual, therefore cold, accretion over tens of millions of years, but rather as a result of an immense explosive impact of a high energy body on one of the great planets, followed by the 'cooking down' of the rebounded mass to a high average density as its orbital energy is rapidly converted to heat. This catastrophic scenario of terrestrial planet formation does not suffer from the serious problems encountered in the current paradigm, both in explaining the initial stages of accretion of small refractory particles and the process whereby the occasional impacts of planetesimals spread over ten million years results in the differentiation of the iron core and the fractionation of the naturally radioactive elements into the crust.

Further implications of this paradigm are (a) that *only the great planets formed at the inception of the solar system*, which took place in the zone far enough from the Sun that ices could act as binders and (b) that *each terrestrial planet has a unique age.*

Additional orbital energy was lost as the result of innumerable interactions with Mars causing it to be ejected from its *ancient interior orbit* into one which intersected that of the Earth (4). In less than 50 years, the solar braking combined with these exchanges of orbital energy reduced the eccentricity of proto-Venus so that it no longer crossed the orbit of the Earth.

The Venus-Earth Spin-Orbit Resonance

The ‘continents’ on Venus were uplifted as a result of close encounters with priori-Mars and the Earth at the time when its crust was beginning to form. At these times it was again distorted into a teardrop shape and the continents, which were uplifted at the apex, are still settling down. This is consistent with the fact that the mountains on the continents do not have volcanic calderas. Venus remained in an eccentric orbit which approached the Earth at inferior conjunctions for about 3,000 years. It was during this period that the tidal force of the Earth on the recently uplifted ‘continents’ of proto-Venus induced its retrograde rotation and its spin-orbit resonance with the Earth. This is illustrated in Figure 1. The continents have since settled onto the still liquid interior leaving little gravitational asymmetry, which is why the resonance is currently dismissed as a mere coincidence.

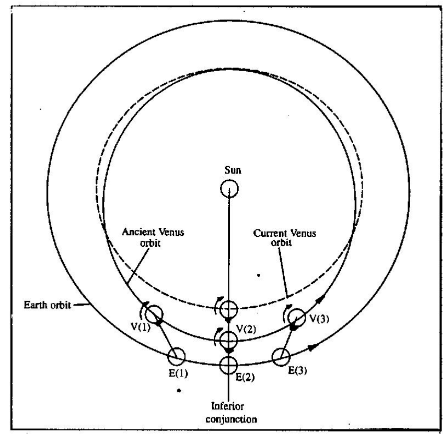

Figure 1 Tidal torque exerted by the Earth on one of the ‘continents’ of proto-Venus, at hundreds of close inferior conjunctions, induced its synchronous retrograde rotation.

Venus’ High Surface Temperature

We claim that the Venus we observe today is only some six millennia old. Its high surface temperature is the legacy of its recent catastrophic birth and subsequent heating events. The interior of this new planet contains an enormous amount of heat which is the single factor driving the atmosphere below 50 kilometers (150,000 feet.) As a result, the temperature, cloud and wind profiles, as a function of altitude, are identical planet-wide regardless of latitude or even whether it is day or night. This view is also consistent with the large measured up-welling radiation which dominates the down-welling radiation at all altitudes.

The large amount of radiation escaping was measured by five different Pioneer Venus vehicles. In fact, a number of analyses, discussed below, were published confirming that its intensity is approximately

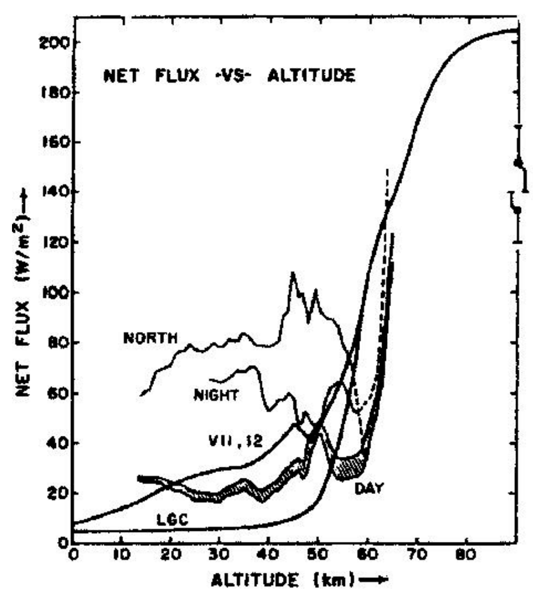

Figure 2 Calculated model net flux radiation (LGC) compared with measured values.

250 times that radiated by the Earth. *The large net radiated energy measured by the Pioneer Venus instruments essentially ruled out the runaway greenhouse effect (RGE) hypothesis of Sagan and Pollack as the cause of the high temperature.*

The carefully worded NASA report *Pioneer Venus*, belies the truth of the matter (5). In fact, it fails to support the runaway greenhouse effect, since these words are never used. It states only that a [ordinary] greenhouse mechanism is apparently active between 50 and 35 kilometers, and that 'global dynamics' transfer the heat down to the surface. But the temperatures where the greenhouse effect exists, are only about minus 13 and 63 degrees Celsius. At most, the greenhouse effect creates a temperature comparable only to that at the surface of the Earth, and any 'global dynamics' must provide the means by which the temperature is increased to the 475 degrees, measured at the surface of Venus. This is precluded by the stable stratification of the lower atmosphere, and the absence of significant horizontal winds (6).

Based on the small amount of H_2O measured by Venera 11 and 12 and the large up- versus down-welling thermal flux measurements from Pioneer Venus Net Flux Radiometers on three separate probes (SNFR), Pollack and his successors pushed every parameter to its limit in order to make the runaway greenhouse model reproduce the measured surface temperatures. But the model has never come close to duplicating the up- and down-welling radiation measured by the three SNFR instruments in the lower atmosphere (Figure 2). *This is a fatal flaw in what is essentially a one dimensional radiation model.* To compound the problem, the model predicted that the atmosphere as a whole was losing energy by thermal radiation to space at a rate of about 205 W/m^2 - an amount far in excess of the incident solar energy absorbed by the planet, which is 132 ± 13 W/m^2, thus contradicting the fundamental assumption on which it is based - that the Sun is the sole source of heating.

In one paper (7), Pollack ignored the *measured* up-welling radiation and instead contrasted the measured down-welling flux with an ‘expected’ value of up-welling energy predicted by a theoretical paper (9) written prior to the Pioneer Venus mission. Assuming Venus is an ancient planet, he dismissed the possibility of a significant internal heat source and declared that solar heating is the sole determinant of the surface temperature. Pollack acknowledged that the measured net cooling flux is two or three times greater than predicted by his model, stating that “better understanding” of the data is necessary. This has never been realized.

Several other papers, published after the Pioneer Venus mission, confirm the fact that the data indicate much more energy is being radiated from the planet than is being received from the Sun. Measurements made from the orbiter outside the atmosphere, indicate that Venus is radiating 153 ± 13 watts/meter^2 while absorbing only 132 ± 13 watts/meter^2 from the Sun, *constituting a net outflow of 21 watts per square meter over the entire surface of the planet (6)*. Discussing the net upward flux measured by the four probes that sounded the atmosphere, the same paper states that below 13 km Venus is radiating a net flux of between 15 and 30 watts/m^2. In fact, a large part of the data from the most sensitive infrared radiometer (LIR) on the large probe, designed to detect visible and near infrared, were *discarded* because, from the lower cloud layer (~ 48 km) to the surface, "all channels produced signals that increased unreasonably" (9).

Thus independent measurements on five vehicles, one measuring the energy emitted into space from the cloud tops, and four measuring some component of the up-welling or net (up-welling minus down-welling) energy flux in the atmosphere at completely different geographic locations, are consistent and indicate that Venus is radiating an enormously larger amount of energy than it receives from the Sun. In spite of this data, the authors of every one of these papers deferred to the theoretical model of Pollack, suggesting that all five of the radiation instruments on which their analyses are based, might be in error - even though there was no indication of problems in the calibration data.

Based strictly on a thermodynamic analysis of the Pioneer Venus radiation data another group stated that neither the greenhouse effect nor global dynamics can explain the net outflow of energy, and that an internal source on Venus must be responsible for the emanating some 250 times the flux radiated by the Earth (10). Unfortunately, these authors also defer to the Pollack model, suggesting the possibility of instrumental error or that perhaps two of the three small probe sites are atypical of the planet as a whole.

Later re-analysis of the SNFR and LIR measurements were said to identify 'plausible' sources for the measurement 'errors' and derived 'corrected' fluxes (11). When these were incorporated into the model they only confirmed earlier results which suggested that an additional source of thermal opacity was required to match the Pioneer Venus data. In spite of all attempts to address the so-called 'opacity deficit', a complete, self-consistent model of the Venus deep atmosphere thermal structure has still not been developed.

The universal deference to a theoretical model in the face of multiple consistent contradictory measurements might be understandable initially, because the data were unexpected, but adherence to the model after all the 'adjustments' have been exhausted can no longer be justified. The continuing devotion to the model after some twenty years is apparently based on the *assumption* that there is some 30,000 times as much CO_2 in the atmosphere of Venus than in the atmosphere of the Earth. Since CO_2 is considered a greenhouse gas at the low concentration found in our atmosphere, it is reasoned that the effect should be very much stronger on Venus, thereby qualitatively justifying the heating effect. This argument is weakened by the fact that atmospheric water, not CO_2, is the most effective greenhouse gas on Earth. *Notwithstanding, in a later section we dispute the very notion that the lower atmosphere is dominated by* CO_2.

The more fundamental reason for the devotion to the model is the adherence to the old Weltanschauung - that all the planets were created more than 4.5 billion years ago, and have cooled to the point that the energy flux from the interior 'must be' insignificant compared to the influx from the Sun. As long as this is accepted, or enforced, by the planetary science community, only very earth-like interpretations of the data from Venus are possible. *There is absolutely no scientific justification for this assumption.*

Another example of this bias is the interpretation of the LSFR solar net flux data for the 0.4-1.0 μm band, intended to measure the intensity of down-welling solar radiation as a function of altitude (12). This flux actually *increased as the probe descended through the lower cloud layer and again as the probe approached the surface* (Figure 3.) These increases were explained as being due to the broadening of the LSFR filter with increasing temperature. However, the authors do note with surprise that very little solar radiation is apparently absorbed in the densest lower cloud layer (6). Despite these questionable anomalies, the measured LSFR flux at the surface was assumed to represent the amount of sunlight reaching the surface, and was used as the energy input to the Pollack model (17 w/m^2). Although the value was larger than anticipated, it was of course used because it helped the model produce higher temperatures.

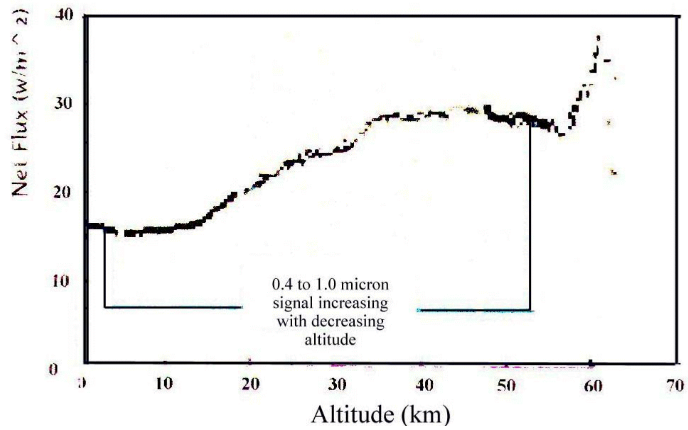

Figure 3 Pioneer Venus LSFR solar net flux data versus altitude, showing increasing flux with decreasing altitude in the lower cloud layer (right) and near the surface (left).

In contrast to this interpretation, we maintain that the short wavelength radiation below the lower cloud layer is due to very hot, raw lava lying exposed in cracks and fissures all across the surface of Venus - with temperatures exceeding those measured on Io by Galileo (2,700 degrees Celsius). The visible and near infrared radiation is scattered in the lower atmosphere. Cracks containing raw lava, are associated with many types of features such as the pancake features in Figure 4. The glow from the exposed lava would have been discernable in photographic images if any had been taken below the lower cloud layer, but no camera was carried on the Pioneer Venus mission or the Vega balloon probes. The Magellan imaging radar, which utilizes reflected radio waves, obviously could not detect glowing material. However, Magellan did examine the surface for emissions in the radio spectrum and found that they were strongest in the low lying areas. We suggest that this was due to the 'tail' of the black body radiation from the hot lava.

We maintain that the last remnant of the solar radiation is essentially extinguished in the dense lower cloud layer. As the large Pioneer Venus probe descended through this layer, the diminished light from the sun was 'replaced' by scattered visible and near infrared radiation from the surface lava. This is why the LSFR instrument saw an increase in short wavelength flux as it passed through the lower cloud layer. Similarly, the increase in the LSFR signal as it

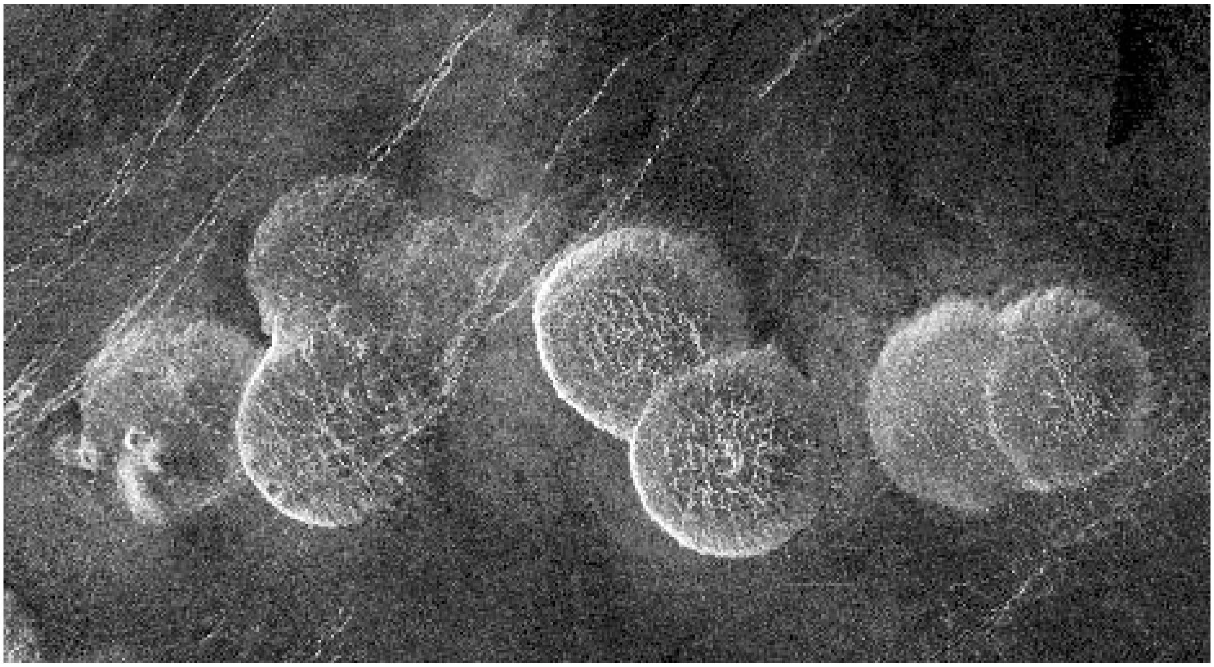

Figure 4 Several Venusian volcanic ‘pancake’ features imaged by NASA Magellan radar. Each is some 65 km in diameter and only one km high with slightly concave tops.

approached the surface was due to radiation from lava in the general vicinity which was scattered back toward the surface by haze and clouds. This is also consistent with the radiation increase sensed by all the data channels of the short-wave sensitive infrared radiometer (LIR) below the lower cloud layer - the data which were dismissed because the radiation intensity in all channels “increased unreasonably.”

The scattered ‘lava light’ is what made possible photographs of the surface by the Venera landers, without the use of artificial lighting. The light is red, not due to Rayleigh scattering of incident sunlight, as currently imagined, but because the black body temperature of the lava peaks in the red part of the spectrum. The light sensed by the Pioneer Venus nephelometer on the night side of Venus, which was declared 'spurious', was probably also due to this glowing lava.

The intensity of the up-welling radiation near the surface varies from locality to locality depending on the surface features. Much more radiant energy is emitted where raw lava is exposed. This is consistent with the variability in the measured up-welling radiation sensed by the different Pioneer Venus probes as they approached the surface.

Volcanic Surface

Because of its young age, the ‘crust’ of Venus is very thin, considerably less than one kilometer. Unlike the crust of the Earth which rests upon the rigid mantle, it is floating directly

Figure 5 Photograph of Venus' surface taken from Soviet Venera 14, which landed on the plains south-east of Beta Regio. Similar igneous rock surfaces were found at all the Venera sites.

on top of the molten interior. As time passes it will gradually thicken but it will probably take million of years for the formation of a lithosphere like that of the Earth or Mars. Although the tidal distortions caused by its close approaches to priori-Mars and the Earth have ceased, the tenuous crust is still rife with vents and cracks through which the interior heat is escaping.

The surface photographed in the immediate vicinity of the landed Venera spacecrafts, Figure 5, is one of a continuous flat igneous rock. This is the virgin surface of a new planet, not the result of an imagined 'resurfacing' that occurred a half billion years ago. It was the same at all six Venera landing sites, and by extension, over the entire planet. The surface rock layer exhibits many cracks but the rocks remain in place. The cracking was probably caused by the global flexing of the planet during encounters with the Earth and Mars, or is perhaps merely the result of differential cooling of the rock with depth, due to the large thermal gradient in the crust. There is almost no dust because there has not been any time since its creation for significant weathering, and also because there is not now and never has been water at the surface of Venus.

Using scintillometer data from a number of Venera landers, Russian scientists (13) have measured the ratios of the naturally occurring radioactive elements Thorium, Uranium and Potassium and compared them to rocks produced by the known petrogenic processes on the Earth. They conclude that the surface rocks on Venus are either derived from some unusual composition of mantle sources or *from an unusual fractionation process for which there is no analog on Earth.* This is to be expected on Venus because this is a virgin surface not yet exposed to any type of earth-like petrogenic process.

Unlike the ponderously slow diapers which rise through the solid mantle of the Earth, the magma plumes in the interior of Venus comprise super-heated liquid rock which rises rapidly through the molten interior. They push the thin crust upward in a circular shape where they strike the surface, producing the ‘pancake’ features shown in Figure 4.

The higher temperature of the plume magma melts the crust from the bottom upward during its impingement and stretches it, resulting in the cracks shown in the Magellan radar images. After the plume is spent, the pancake features gradually collapse as evidenced by their concave upward shape noted in stereo studies. The fact that the coronae are so much larger than the fresh pancake features, is probably an indication that the plumes were larger in the earlier millennia of the planet. Their asymmetry is probably due to planet-wide distortions that occurred during encounters with Mars or the Earth.

The sinuous channels, lava 'rivers' thousands of kilometers long, which present such a dilemma to planetary scientists, provide another confirmation of our hypothesis. The reason that the lava appears to be flowing for such great distances in these channels is because the channels are not at the temperature of the surface. We claim that raw molten lava lies in these ‘rivers’ today. Because the surface crust is very thin and the interior is boiling rock, there is a very large temperature gradient in the thin crust. As a result, the bottoms of the channels, in which this lava lies, are much hotter than the surface, keeping the lava fluid and glowing and providing one means of dissipating heat from the interior. The fact that many craters are flooded with lava is evidence that the impacting bodies punched completely through the thin crust, allowing the hot lava to flood up from the interior to the 'sea level', which is really a 'lava level' in the present hellish surface environment.

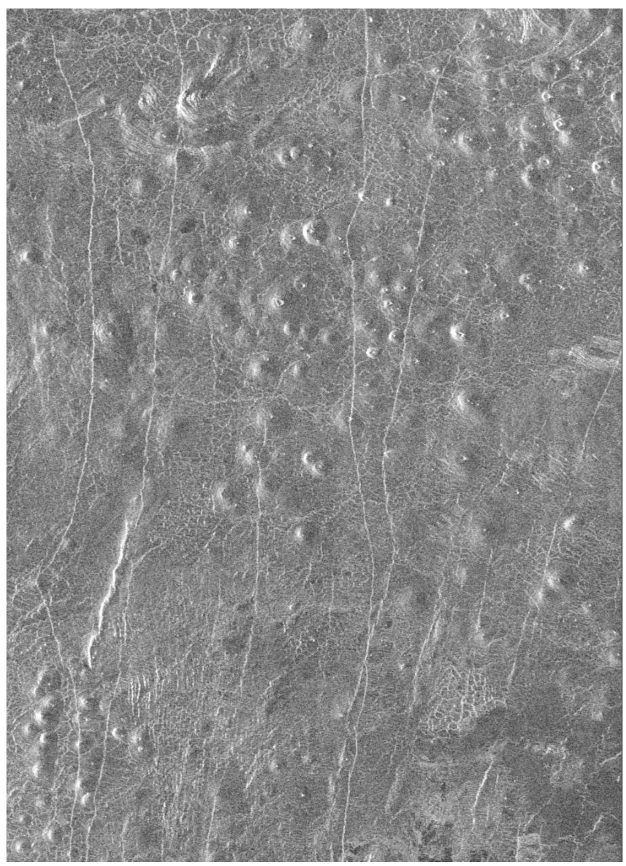

Figure 6 A Magellan radar image of one ‘dome field’ on the surface of Venus.

Many investigators have expressed surprise at the 'freshness' or 'pristine nature' of the surface features in the radar images, in light of the currently accepted notion that these features are hundreds of millions of years old. Scientists rationalize this youthful appearance as being due to the thick atmosphere having protected the surface from deterioration by small-meteorite bombardment over the hundreds of millions of years since these features were formed and the lack of liquid water, which is a major factor in weathering features on the surface of the Earth. Our explanation is much simpler - these features formed in the last few thousand years. They appear new because they *are* new.

By far the most ubiquitous feature identified on the surface of Venus are the 'small domes,' - the name given by Russian investigators who first saw them in Venera radar images. *The higher resolution Magellan imagery has revealed more than two hundred thousand of these features,* classified as small 'shield volcanos' by US scientists, spread over the whole planet in the 'plains' - the lowest lying terrain. An example of one dome field is given in Figure 6. The domes are circular, generally less than 2 km in diameter, have slopes typically 5 degrees, with a hole or pit at the summit. Researchers have proposed that they may result from a unique high viscosity lava species which oozed slowly out on the surface and ceased to flow further. However, this theory does not explain why they are symmetrical, since even viscous lava would flow in the direction of the local slope, or why the lava does not form a cap over the vent. We claim that planetary scientists have failed to recognize the importance of these features. *These ubiquitous domes are the single most important surface features on Venus, because understanding their function leads to the explanation of the true nature of the planet.*

The Hadesphere

We maintain that the Jovian moon Io is a close cousin of Venus, both having been born as a result of the catastrophic '*Little Bang*' on Jupiter some 6,000 years ago. As such, Io serves as a visible example of what is happening on Venus beneath its veil of clouds. Io's internal heat is being released by several mechanisms. The primary mechanism is via gaseous plumes extending hundreds of kilometers into space in beautiful parabolic patterns. Ejection velocities are estimated to be as high as 1,000 meters per second and analysis of images from Galileo satellites indicate that as much as 100,000 tons of material are being erupted each second from this modest sized moon. Color renditions of Voyager photographs of the surface of Io show the colors characteristic of several forms of sulfur deposited in their vicinities. Radiation from super-hot lava flows is the other cooling mechanism.

We propose that the same thing is happening on Venus - but on a much grander scale. Venus is a more massive body, with far greater internal heat, resulting from its recent catastrophic 'birthing' process. The two hundred thousand plus small domes are active vents through which gaseous sulfur is continuously being ejected from the interior at high velocity, ascending some 48 kilometers into the atmosphere. Given the greater size and heat content of Venus, we estimate that it is currently venting *billions of tons per second. The mass of sulfur being continuously vented from the two hundred thousand domes creates a lower atmospheric zone that is unlike anything previously imagined by planetary scientists. Therefore, we coin a new term for it here - the 'Hadesphere'.* None of the vented sulfur can escape directly to space as it apparently does on Io, because of the stronger gravity and the dense atmosphere. As a result, a massive amount of large sulfur molecules and crystals are trapped and suspended in the lower atmosphere at any given time.

The atmosphere near the surface is Hades personified, as evidenced by the total failure of all the Pioneer Venus probes below 14 kilometers (greater than 40,000 feet above the surface!) The combination of high pressure venting of gaseous sulfur with the high heat, caused failures in practically every sensor system. This was not an isolated incident. All the probes suffered the same problems at about the same altitude, even though they were thousands of kilometers apart in different parts of the planet, including both the day and night sides.

The totality of the probe instrument failures suggest that the concentrations of sulfur compounds increased as the probes descended through the lower atmosphere yet the mass spectrometer gave a total mixing ratio, for all sulfur compounds, of slightly more than 1 part per thousand, relative to the CO_2 (mass 44) count. Because the data from the instruments indicated small mixing ratios for the *anticipated* sulfur compounds, the project scientists failed to recognize the significance of such massive probe failures. Possible evidence of the ubiquitous sulfur venting comes from the Vega 2 lander, which measured highly variable super adiabatic lapse rates as high as -10 K/km below 1.5 km.

Although the Pioneer Venus data showed the pre-mission model of atmospheric chemistry to be in error, the revised models all have similar flaws, in that they are based on the assumption of an ancient planet in thermo-chemical equilibrium with a fixed complement of molecular species. None include sulfur in the high temperature form S_N, where N is typically 8 or greater, the form taken by sulfur at the temperatures in the lower atmosphere. All fail to produce a crystalline lower cloud layer consistent with observations. The models ignore the possibility that gaseous materials, formed in the volatile-starved *interior* of a super-hot new planet, could be continuously injected into the system. Unfortunately only those molecular species anticipated by the atmospheric chemistry experts prior to the mission were considered when designing the instruments and interpreting the data from the probes.

Compelling evidence of the total domination of the lower atmosphere by massive amounts of sulfur, vented from the interior, is presented in Figure 7. Sulfur takes on a number of crystalline and vapor forms depending on its temperature. Using the temperature versus altitude data from the Pioneer Venus probes, we have annotated the altitudes at which these forms change at the right of this figure, the left part of which is reproduced from the Pioneer Venus report (5). This simple comparison reveals the dominance of sulfur and its compounds.

First,*the estimated surface temperature of Venus (444 degrees Centigrade) is only slightly greater than the boiling point of sulfur.* This implies that without the continuous evaporation of sulfur, the surface would be considerably hotter. An enormous amount of sulfur must be continuously 'raining down' and evaporating in order to limit the surface temperature, which would otherwise be much greater.

Second, the enormous mass of sulfur being continuously vented from the interior carries off even more heat than the recycled, evaporating sulfur, because of its higher temperature. The

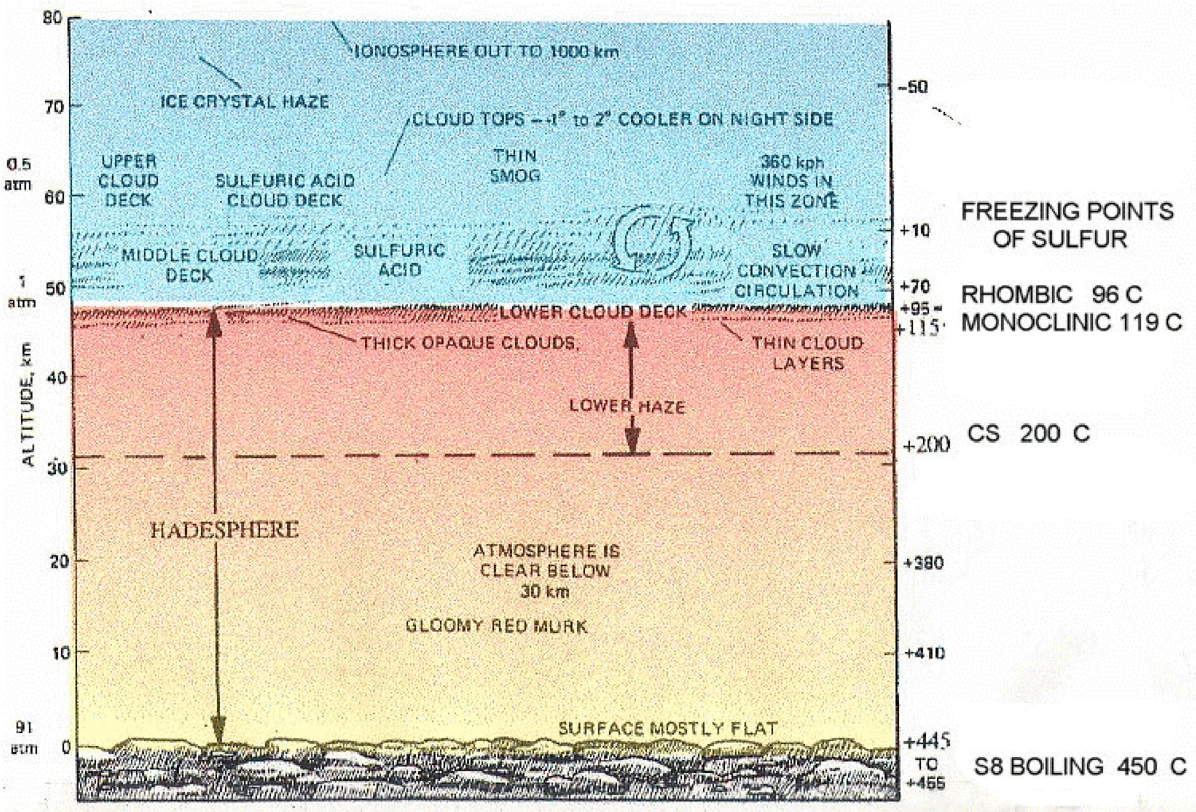

Figure 7. Cloud and haze structure measured by Pioneer Venus as a function of altitude, at left. At right we have annotated the altitudes at which sulfur forms rhombic and monoclinic crystals, and CS crystalizes, showing that these correspond to the lower cloud layer and the haze layer just below it, which are present, both day and night, at all the probe locations.

high speed of its ejection sends it upward so rapidly that convection, as experienced in our atmosphere, is overwhelmed below 48 kilometers (160,000 feet). The sulfur vented from the interior is primarily in the form of S_8, *a staggered-ring shaped molecule* pictured in Figure 8. As this gas jets to higher altitudes it cools and crystallizes.

Third, *the S_8, freezes to form a monoclinic crystal, which is constructed of stacked rings.* The thin cloud layer (at 46 kilometers) just below the lower cloud is at exactly the temperature *(119.28 degrees)* at which monoclinic sulfur crystals form. The release of heat due to this physical change carries the crystals still higher.

Forth, the primary cloud feature on Venus, the lower cloud layer, corresponds to the temperature (95.5 degrees Centigrade) at which sulfur changes from a monoclinic crystal to a orthorhombic form. This reaction releases additional heat. Because the density of rhombic sulfur crystals is greater than the monoclinic form, the tendency for the former to rise due to the release of heat is countered by its higher density, causing it to fall back down into the higher temperature zone. Since the reaction from one crystal type to the other is completely reversible, one would expect a unique atmospheric entity to form at this altitude - *this is the lower cloud layer which is the single most ubiquitous atmospheric feature on the planet.* As would be expected based on this hypothesis, turbulence was measured by the Pioneer Venus probes as they passed through this layer, and the heat released in the freezing process was also detected, as a 20 Kelvin temperature offset relative to an extension of the temperature slopes below 40 kilometers (6).

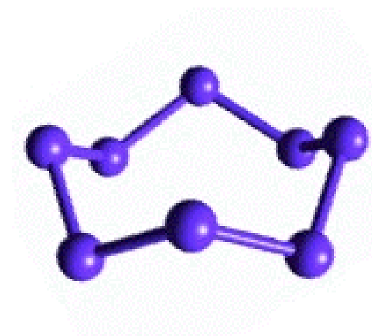

Figure 8 The staggered ring S_8 molecule, which dominates the lower atmosphere of Venus, was not detected by the Pioneer Venus mass spectrometer because its mass is beyond the range of the instrument.

Although the Pioneer Venus nephalometer team was unable to determine the composition of a number of submicron size cloud particles, they were able to delineate several 'modes' based on their mean diameter. *It was determined that the lower cloud layer was composed primarily of mode 3 particles, which are reported to be high aspect crystals (*15). This supports our analysis of the cloud layer as comprising crystals of sulfur, which are formed by the stacking of a number of sulfur rings. The fact that this cloud layer was detected at the same altitude by all probes, on both day and night sides of the planet reinforces the concept that the great heat of the interior is driving the lower atmosphere, or 'Hadesphere'. As a result of this analysis, we conclude that *the concentration of sulfur compounds in the lower atmosphere is not a few hundred parts per million, as interpreted from Pioneer Venus, Venera, Vega and ground-based observations - instead sulfur, in the form S_8, is the dominant species.*

The obvious question is: How has this enormous concentration of sulfur remained undetected? The reason is that *the sulfur molecules, which are vented from the interior and are stable at the temperatures in the lower atmosphere, S_8 and larger, are beyond the maximum mass limit of the Pioneer Venus mass spectrometer and the gas chromatograph is not capable of sensing them* (16). Lastly the crystals formed when they freeze cannot be identified by the nephelometer instrument because they are not spherical droplets.

The High Atmospheric Pressure

Because of the great number of active vents and the high velocities at which large volumes of sulfur are being expelled every second, an enormous mass of sulfur is suspended in the atmosphere up to 48 kilometers. *It is these heavy molecules and crystals which load down the atmosphere, causing the high surface pressure (some 92 atmospheres).* This implies that the large mass of CO_2 assumed to be the cause of the high pressure is not present, and therefore neither is the primary source of the hypothesized runaway greenhouse effect.

Atmospheric Barriers

Due to the *massive upward flow* from the surface vents, two well defined physical and chemical boundaries exist at characteristic temperatures/altitudes. *These are evidenced by molecular species gradients as a function of altitude.*

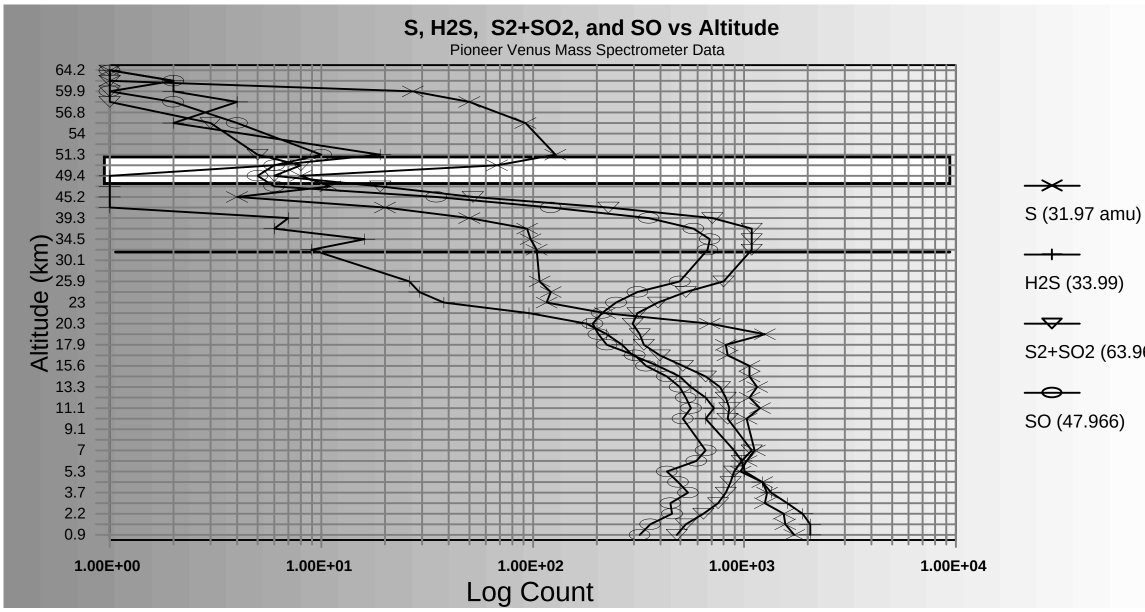

Figure 9. Pioneer Venus mass spectrometer counts showing the dramatic reduction in sulfur compounds S, H_2S, S_2+SO_2 and SO with increasing altitude below the lower cloud layer.

The primary barrier, located at the lower cloud layer where sulfur crystalizes, prevents the flow of sulfur from continuing upward, as discussed above. An indication of this boundary is found in the mass spectrometer profiles of S, S_2, SO_2, in Figure 9, which shows the measured sulfur compounds dropping several orders of magnitude around 48 kilometers. This is due to the formation of sulfur crystals by the rising S_8, the surfaces of which catalyze reactions which capture sulfur.

The data also suggest a second barrier at an altitude of 31 kilometers. The region between these barriers is characterized by a reduction in the amount of carbon present in gaseous compounds, as illustrated by the mass spectrometer records of CO, CO_2, and COS in Figure 10.

This altitude corresponds to the bottom of a layer of thin red haze, which extends upward to the lower cloud layer. We suggest that this is due to the freezing out of a reddish compound in the lower atmosphere, any presence of which in the gaseous state was masked by the large count in the carbon dioxide channel. This compound, carbon monosulfide (CS), has a mass of 44 amu, almost exactly the same as carbon dioxide. It is either formed in the high temperature, volatile starved interior and vented into the atmosphere along with the sulfur, or it forms in the lower atmosphere. CS is not unknown to space scientists, having been detected in a number of distant galaxies, comets and in the plasma plumes produced by the larger Shoemaker-Levy 9 impacts on Jupiter. Indirect corroboration of the presence of CS in the lower atmosphere of

Venus comes when we plot its freezing temperature, 200°C, on the altitude scale at the right of Figure 7. *It corresponds exactly to the bottom of the reddish haze layer at an altitude of 31 kilometers in the Pioneer Venus report.*

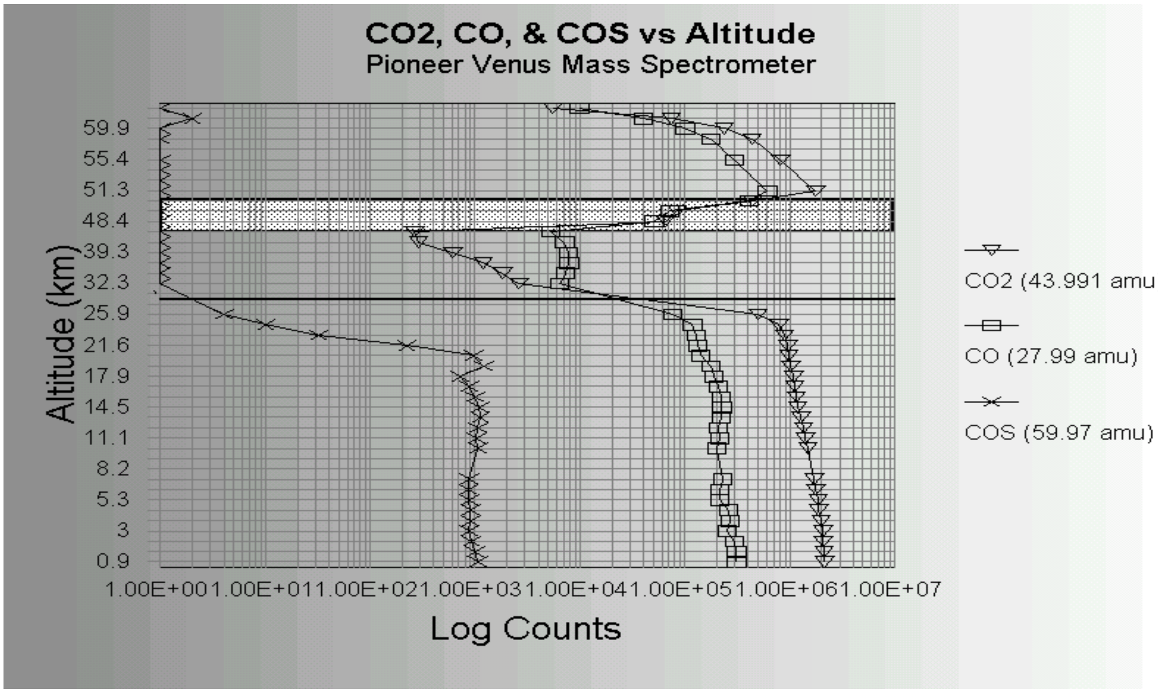

Figure 10. The concentration of carbon dioxide, carbon monoxide, and COS as a function of elevation in the atmosphere of Venus from Pioneer Venus mass spectrometer showing the dramatic drop in these compounds between 31 and 48 km, the bottom of the lower cloud layer.

The rising CS crystallizes at 31 kilometers, and the mass upward flow carries the crystals upward as far as the lower cloud. Their presence apparently has a profound effect on the chemistry in that altitude range. We suggest that the affect of the CS crystals is the reduction of carbon from other compounds, for example CO_2, CO and COS (Figure 10), which all drop dramatically between 31 kilometers and the lower cloud layer. The fact that the most stable of the carbon compounds, CH_4, shows no such decline through this region is a strong indication that this is indeed a chemical barrier, and may also indicate that both carbon and oxygen are required. The process is similar to that at the primary sulfur barrier in that the crystallization of a compound, in this case CS, catalyzes a number of complex reactions which capture carbon. *Such gradients in molecular species can only be understood in the context of a mass flow environment.*

As shown in Figure 10, the CO_2 channel counts from the Pioneer Venus mass spectrometer dropped dramatically as the large probe descended through an altitude of about 50 kilometers (17). This unexpected drop in what was *assumed* to be the dominant constituent of a well mixed atmosphere, was interpreted by the Pioneer Venus scientists as being caused by a blockage of the inlet leak. The mass 44 count rate recovered gradually and then increased rapidly some three orders of magnitude around the 31 km level. This rise was interpreted as being due to the evaporation of the sulfuric acid droplet which had blocked the small leak, implying that the measurement of carbon dioxide resumed at this altitude.

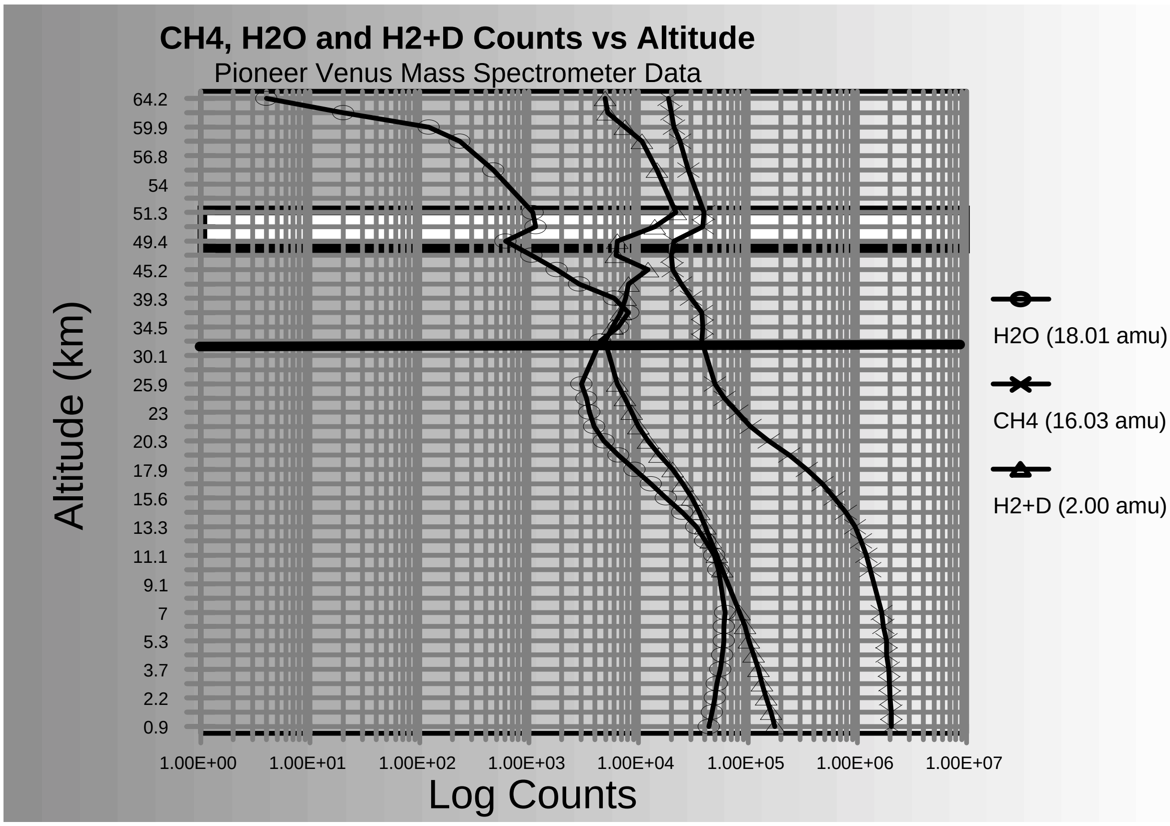

Figure 11. Mass spectrometer counts of H_2O, CH_4, and H_2 (or D) versus altitude showing that the mass spectrometer leak was not blocked between 50 and 31 km. It also shows that CH_4 failed to suffer the depletion as did the less stable carbon compounds.

This explanation involved a monumental leap of faith, taken in order to preserve the preconceived notion of what the data 'should have shown.' *It was particularly incredible in light of the fact that at the time of the decrease in the mass 44 channel there were two inlet leaks, one five times larger than the other, and that a number of the mass spectrometer channels showed no such dramatic decrease in counts.* Figures 9 and 11 show that the mass spectrometer counts of SO, SO_2, H_2O, H_2 + D, and CH_4 do not register any 'drop-out' between 31 and 48 kilometers, characteristic of CO_2, proving that the input leak was not clogged.

As a result of this analysis we suggest that: (a) The large variations in the Pioneer Venus mass spectrometer 44 amu channel data were real, that is, they were not due to a clogging of the instrument input leak; (b) At 31 kilometers the temperature was such that CS solidified into crystals which catalyzed the reduction of carbon from COS, CO_2 and even the relatively stable compound CO (but not the most stable CH_4); (c) The haze layer extending upward from 31 kilometers to the lower cloud layer is due to crystallized carbon monosulfide that is carried upward by the high velocity mass flow of sulfur from the interior, affecting the chemistry in that entire altitude regime.

Two Tiered Atmosphere

We propose that the upper and lower atmospheric zones observed on Venus were acquired through different processes. As discussed above, the lower atmosphere is the result of continuous, on-going out-gassing from the interior of the planet itself. But the bulk of the atmosphere above 50 kilometers was probably acquired in various ways. The O_2 and H_2O incorporated in the sulfuric acid clouds are either molecules that never escaped proto-Venus or those that were lost into interplanetary space during the super-hot out-gassing stage that were swept up millennia later when the planet had cooled.

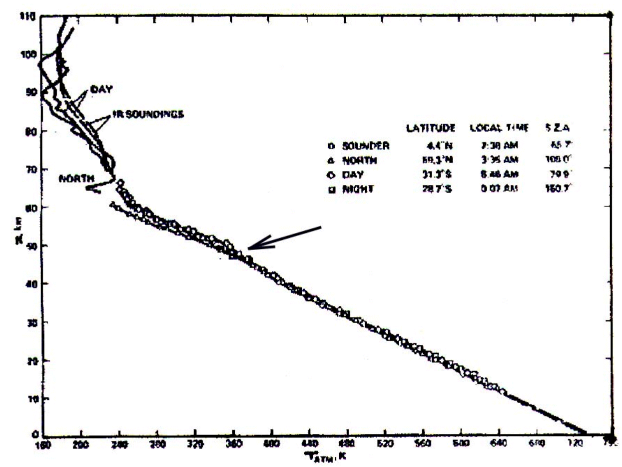

Figure 12 Temperature versus (derived) altitude profiles in the atmosphere of Venus from four Pioneer Venus probes in completely different parts of the planet were virtually identical. The arrow indicates a subtle change in slope around 48 km.

Above 50 km the temperature is a 'balmy' 70 degrees centigrade and the pressure is about 1 atmosphere - quite Earth-like, with stratus clouds, in which the incoming sunlight apparently causes more familiar global circulation patterns. Possible evidence of the atmospheric boundary characterizing the two-tiered atmosphere, can be seen as a slight change in the slope of the temperature versus time plot around 48 km (Figure 12).

In October of 1994, the spectacularly successful NASA Magellan engineering team performed one last experiment with their beloved ‘bird.’ After having mapped the entire planet twice with its imaging radar and then collecting gravitational data for some two more years, it was called upon to estimate the atmospheric density at high altitudes as it made its final plunge. As with many of the data from Pioneer Venus, the results were unexpected. Based on the surface pressure, and assuming a standard atmospheric pressure profile, project scientists had predicted a value of atmospheric density twice the magnitude of what was calculated from its rate of descent at altitudes between 150 and 160 kilometers above the surface. We suggest that the reason for the deviation from the standard atmospheric pressure profile lies in the unusual two-tiered nature of the Venusian atmosphere.

The Evolution of Venus' Atmosphere

As Venus cools, the temperature, volume and velocity of the sulfur gases being vented from the interior will gradually decrease. As a result the surface pressure will decrease as the Hadesphere gradually collapses toward the surface of the planet. When the temperature of the interior is sufficiently reduced and the crust has thickened, the venting of sulfur will cease completely, bringing the 'normal' portion of the atmosphere, now at 50 kilometers, down to the surface. How long this will take is not yet known. This scenario holds promise for the evolution of a habitable planet at some future date, in contrast to the currently accepted view that the temperature and pressure is due to CO_2, implying a perpetually forbidden world.

Planetary scientists who are inured to very long time spans will undoubtedly estimate millions of years or more for the collapse of the Hadesphere. But future missions to Venus may be able to determine the actual rate of collapse by noting the amount of reduction in the altitude of the ubiquitous lower cloud layer since 1978. This will make possible a more accurate estimate of the date on which men will be able to safely land on the surface of Venus, and will signal a new stage in its development.

The Super-rotation of the Atmosphere

Our paradigm offers the only cogent explanation of another of the primary mysteries about Venus - the driving force behind the ‘four day’ zonal winds which encompass the planet at all latitudes. This ‘force’ must be continually acting because the atmosphere has no significant angular momentum of its own and its rotation would cease very quickly if the driving source were removed. The close similarity between the day and night zonal wind profiles indicates that the process driving the super-rotation is not confined to the region of the sub-solar point, but occurs everywhere over the planet. *We maintain that the continuous high speed venting of sulfur from the two hundred thousand-plus small domes is the means by which the angular momentum of the solid planet is transferred so efficiently to the atmosphere*. The rotational energy is then amplified at altitudes where energy-releasing reactions occur, producing the 'four day' zonal winds at the cloud tops. *The maintenance of the planet-wide zonal wind is direct evidence that a tremendous mass of material is continuously being vented into the atmosphere*. Since the gases are vented vertically at the surface there were no significant horizontal winds sensed by the Venera landers.

Differentiation and Magnetic Field Generation

The earth-like average density of Venus implies that it possesses a significant amount of iron. The iron in Venus has already become differentiated due to its highly fluid interior. *Our scenario explains how quickly and naturally the process of differentiation takes place early in the development of a terrestrial body.* It is also at the current stage of Venus that the naturally radioactive isotopes of potassium, thorium, and uranium rise toward the surface because of their higher temperatures by fractionation.

In spite of the concentration of iron at the core, there is no magnetic field being generated in the interior of Venus. The field measured by the Pioneer Venus orbiter spacecraft was extremely weak and was created by interactions with the solar wind. The lack of an internally generated magnetic field is due to the hot, boiling, chaotic nature of the interior. Only when the interior cools sufficiently will a solid iron core form, making possible the generation of an internal magnetic field.

Experimental Corroboration of the V/A Hypothesis

Venus is a new planet. Its recent creation in proto-historical times provides an example for mankind of how all terrestrial planets originated. Once this is recognized, it will provide us with a 'laboratory' in which the early stages of planetary evolution and the early development of life precursor molecules. It would be a great shame if we fail to experience this adventure for more decades, because of the inability to accept a wider range of ideas.

Given two completely different theories concerning the planet Venus: the conventional one, in which all the terrestrial planets accreted 4.5 billion years ago, and the new catastrophic theory presented here, the question is - What future measurements or analyses can be made that would identify the correct paradigm?

Future Venus probes should be designed to make absolute identification of all species of gases, including large molecules and particulate matter in the atmosphere. To this end an infrared spectrometer should be used in conjunction with the mass spectrometer. It would also be desirable for these instruments to analyze the atmospheric constituents at ambient temperatures to prevent their condensation upon entering the instrument.

Since the Pioneer Venus mission has proven the striking similarity of temperature, pressure, cloud, and atmospheric chemistry at diverse locations over the planet, it would make sense to design a single heavily instrumented probe which descends more slowly through the atmosphere, with no concern for its longitude variations during the descent. This would allow time for all of the measurements to be made at ambient temperatures and transmitted to an orbiter or directly to the Earth. Once the probe descends below the lower cloud layer its altitude could easily be maintained by a balloon to increase 'hang time' at the more moderate temperature altitude, as was done with the Soviet Vega probes.

Near infrared and conventional photography of the surface is absolutely necessary in order to detect glowing lava on the surface. However, the ability of such photographs to reveal the actual gases being vented from the domes is doubtful. These can be seen on Io only because they freeze and are viewed at the limb against the black background of space. A new instrument should be designed to measure the net upward flow of sulfur in the lower atmosphere.

Our scenario predicts that Venus is not in a steady state condition. Indeed, a continuous decrease in the amount of sulfur dioxide in the highest clouds of Venus has already been measured remotely since the Pioneer Venus mission in 1979. Advocates of a steady state Venus are forced to explain this as being due to the eruption of a large volcano just before that mission, since they absolutely cannot believe the planet is cooling continuously at a significant rate. Also, changes were noted in the circulation patterns of the high altitude winds in the interim between the Mariner 10 and Pioneer Venus missions.

Thus comparisons of new measurements with those of Venera and Pioneer Venus are important because they will show any systematic changes which have occurred since 1979. For this reason it will be crucial to calibrate any new instruments against those used on Pioneer Venus, or to duplicate the latter and add supplemental ones. Over twenty-five years will have elapsed since the Pioneer Venus, Venera and Vega missions, and the chances that systematic changes will be detected by future spacecraft improve with each additional passing year. For instance, it would be of interest to determine if any significant change has occurred in the extent of the 'Hadesphere' as defined by the altitude of the lower cloud layer. We predict that this will continuously decrease with time, and that the next atmospheric probe will find a measurable decrease in its altitude compared to that found by Pioneer Venus. Care must be exercised in this measurement, because the altitude of the Pioneer Venus probes was not measured directly but inferred from an assumed atmospheric model. Because their rate and angle of descent would have naturally adjusted to the local density, the Pioneer Venus descent profiles as a function of time belie the actual atmospheric structure. The inclusion of a dependable radar altimeter is absolutely necessary to determine the true nature of the two-tiered atmosphere.

Since our hypothesis implies a super-high internal temperature, that is, a boiling interior, and a very tenuous crust, it would be of value to directly measure the rate at which heat is being conducted through the crust, if possible. This could be measured by dropping a spear-like probe which penetrates the surface, and transmits back the temperature gradient in the crust. We predict an extremely high gradient because just below the thin crust is an interior of boiling magma. Although already indicated by the PV radiation measurements, a heat flow between 20 and 30 watts per square meter, would provide further corroboration of our hypothesis.

Given the almost total failure of all down-looking sensors at 14 km altitude, a monumental design effort will be required to allow such sensors to continue to collect data below this altitude. Perhaps a high pressure jet of non-reactive gas could be used to deflect the rapidly rising sulfur.

It is now time to plan a new mission to Venus. The proposed paradigm provides exciting new possibilities and suggests a number of new measurements. Hopefully, our challenge will spur interest in new space missions.

References and Notes

1. We accept the sacred myths as scientific data - observations of cosmic events which have been preserved for millennia. These tell of a 3,000 year period of planetary chaos in triggered by the marauding proto-Venus. Astronomy is an observational science, and it is only logical that the descriptions (observational data) of archaic events had to be in the language of those who observed the events. The Rig Veda is arguably the most ancient organized set of observations in existence. It is written in the form of an epic poem over a thousand stanzas in length, which was augmented for 3,000 years as new planetary encounters occurred and passed down from generation to generation of priests ('*rishis*') by memorization and verbatim chanting for millennia, before ever being 'written down.' Although the Hindus themselves had lost the true meaning of its chants a few centuries after the events ceased, they have kept it intact because of the 'sacred knowledge' which they believe it contains. The enormous amount of information implied by its great length is further enhanced by the fact that it preserves the time ordering of the cosmic events, in contrast to the isolated anecdotal myths of many cultures. Therefore, it is particularly enlightening to note that this enormous impact and its immediate aftermath, described in terms of the birth of the deity 'Aditi' out of the 'head' of Jupiter, is the first event described in this epic.

2. During its early decades the Vedic people referred to proto-Venus by a variety of names due to its different temperatures and positions relative to the Sun and Earth. When white hot the name *Vivasvat* was used by the Vedic people to describe it. It was also called *Surya* (Sun Maiden) when it shone in the sky along with the Sun. After passing through aphelion it was much cooler and when it illuminated a portion of the night side of the Earth, it was called *Pushnan*, the protector of nighttime travelers. But when it approached the Earth, it was the feared deity *Agni* (literally 'fire'), who scorched the Earth and produced tidal waves that swept across entire continents. (Best described in Ovid's version of the Greek myth of Phaethon.)

The multiple names given to the same physical body by ancient peoples have presented great difficulties to earlier interpreters, but they make sense as we come to understand the varying aspects of proto-Venus observed by the Vedic people - its changing temperature brightness, its position in the sky relative to the Sun and its distance from the Earth.

3. The long columns of ash were described in the Rig-Veda as 'two branding irons' with their tips together in the fire, which was proto-Venus. As perspective increased, they were seen as two hands joined in prayer, and finally as a writhing serpent with Agni (proto-Venus) in its mouth, when the smoke tails became convoluted by the magnetic field of the Earth.

4. Indra's (Mars) quaffing of Soma (similar to ambrosia or manna) from Varuna (proto-Venus after the first tenuous crust had muted its brightness) was the Vedic description of a white bridge that formed between the planets during close encounters. The impression was that Indra was 'strengthened' because the encounter 'released him from his ancient bonds' (orbit) and caused him to grow in stature. This implies that Mars moved closer to the earth. Since the

process was one in which the orbital energy of proto-Venus was reduced and that of Mars increased, the implication is that *Mars was originally in an interior orbit*, from which it was ejected by Venus.

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