

THE CALCULATIONS OF GREENHOUSE EFFECT IN THE VENUS' ATMOSPHERE Yu.I.SIDOROV,S.V.PAROT'KIN Vernadsky Institute of Geochemistry and Analytical Chemistry, USSR Academy of Sciences, Moscow,USSR

A simple, idealized model of the greenhouse effect for the three-component gaseous mixture was studied. The model was simulated at different partial pressures of CO_2 , N_2 , H_2O and the solar energy incident flux increment of 25 -30% as a reasonable estimate of the increase in luminosity since the planets were formed [1,2]. Surface temperature (T_s) is determined as a function of solar radiation and of total pressure value of gaseous components ($P_{\text{tot}} = P_{\text{CO}_2} + P_{\text{N}_2} + P_{\text{H}_2\text{O}}$). The net fluxes for molecular atmosphere is calculated by method of Pollack [3] and additional spectral parameters of gaseous components are corrected according [4]. We suggest that the atmosphere composed of water vapor, carbon dioxide and nitrogen could be accumulated as a result of degassing a priori divided into three stages.

A total budget of degassed fraction of CO_2 , N_2 , H_2O on Venus is considered as corresponding to a global inventory of the Earth. The first stage of degassing is assumed to be characterised by the moderate rate of CO_2 , N_2 , H_2O accumulation. So the surface temperature could be predicted to increase gradually exceeding the recent T_s value.

The second stage could be assumed to coincide with the time of the existence of planetary global molted layer which could be formed as a result of energy release at final stages of the accretional process and/or core segregation [5-8]. If the depth of this layer is corresponding to pressure above 1-2 kb, the fluid separated from the melt should contain only carbon dioxide [9]. Accordingly the atmospheric mass was increased mainly at the account of carbon dioxide. The surface temperature should be a function of the water vapor pressure. At the partial pressure of H_2O above 10 bar the surface temperature was found to be $T_s > 1200$ K provoking the melting surface material.

Probably the molted surface material could be joined with the melt in the planetary interior and the degassing rate severely increased. For example the surface basaltic layer of 5-10 km thick should be joined with the interior within 5-10 m.y. On the stage the degassing fluid is assumed to contain mainly water vapor [9]. As a result the partial pressure of H_2O as well as the surface temperature should be increased. The succeeding decrease of the atmospheric mass corresponding to the decrease of T_s up to the beginning of crystallization surface material proceed as a result of the photodissociation of water vapor and the escape of hydrogen. Oxygen formed as a product of water vapor dissociation should be consumed in the oxidation of iron containing in melt.

If based on the Lewis hypothesis [10] predicting the cometary flux and volatile-rich asteroids to be sufficient of maintainance of steady-state abundance of H_2O on Venus the variations of surface temperature must be followed by the stochastic variations in water abundance which was described by Grinspoon and Lewis [11].

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So we considered two possible scenarios of water depletion of Venus: the initial H₂O depletion of proto-Venus' material and the early release of water vapor from the global magmatic surface layer. Both scenarios lead to a single conclusion: the planetary magmatism and tectonics are greatly different from the terrestrial. The possible consumption of oxygen approximated similar to the world ocean could be resulted in the substantial oxidation of surface material.

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