The Temperature Profile of Venus Computed Using The Thermal Pressure, $P_{TH} = aT + b$.

by

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The density and temperature profiles of a planet's interior are calculated using a set of differential equations using the major thermal and mechanical variables of a planet. The procedure used here is characterized by an equation of state where the density and volume effects are separated into two independent functions. The temperature-dependent part of the EOS is found from high-temperature properties measured on minerals at one atmosphere. Our thermal pressure has no reference to a Gruneisen parameter, being simply $P_{TH} = aT + b$. The volume dependence of a and b is taken to be negligible, as evidenced by several experiments. The differential equations are integrated with depth beginning at the planet's surface. Control on the mantle's properties results from physical properties of the minerals in the assumed mantle rock. Lithosperic thickness is an input parameter. The mantle's temperature profile results from assuming a constant viscosity in the convective parts of the planet interior.

Among the properties calculated with depth of the planet are density (ρ), temperature (t), coefficient of thermal expansitivity (α), gravity (g), heat flux (q), and, moment of inertia (I) and residual mass (M). M and I are required to vanish at the center which establishes the properties of the core (core diameter, and compressed cold density of the core).

The density profile $\rho(z)$ is computed by this technique, although seismic travel time and normal mode data are not directly used in the calculation. In the case of the earth, comparison of the density profile is made with that of the PEM model (1). Baumgardner and Anderson (2) showed that the density profiles of these two models are quite close. Figure 1 shows that throughout the deeper portions of the earth the difference is less than 0.5%.

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THERMAL PRESSURE OF VENUS

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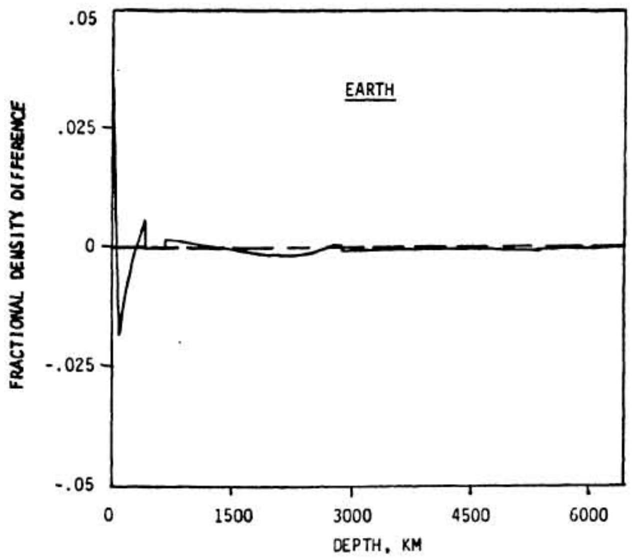

Fig 1 The relative difference between the density distribution of this earth model and the PEM [1].

The temperature profile of Venus is computed and compared with those obtained for the other planets. It appears that there is a common temperature profile if comparisons are made upon a basis of pressure instead of depth. That is, $T(P)$ profiles of the terrestrial planets lie close to a common curve.

References

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2) John R. Baumgardner and Orson L. Anderson. Using the Thermal Pressure to Compute the Physical Properties of Terrestrial Planets. Advances in Space Exploration, COSPAR, Pergamon Press, in press; O. L. Anderson and J. R. Baumgardner. Equations of State in Planetary Interiors. Proceedings of the Lunar and Planetary Science Conference, 11, in press (1981).