LAYERED CONVECTION IN PROTO-STELLER NEBULA: IMPLICATIONS FOR PLANETARY FORMATION AND TITIUS-BODE LAWS.

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The collapse of a protostellar nebula will create both a compositional gradation and a temperature gradation from the center of the cloud outward, heavier components and higher temperatures to be found increasingly toward the center. Soret convection then should take place within the cloud. It has been long known that Soret convection takes place in gases with temperature and concentration gradients and occurs at high temperatures in plasmas also. There is reason to believe that the convection will manifest a layered structure similar in form to that seen in liquid double diffusive systems. When the nebula has collapsed to a disk, the disk should consist of a number of concentric annuli, each annulus a layer of convection of uniform composition and temperature throughout. Only at the boundary layers seperating the annuli are there significant temperature and compositional gradients, each boundary layer completely encircling the proto sun. The major mode of convection will be radially directed, toward or away from the proto-sun. Outward convection will be retrograde in terms of the angular motion of the disk and inward convection will be prograde which will generate shear in each boundary layer such that vortex motion will be set up with angular momentum in the same direction as that of the disk. A pressure low within the vortex will assist in the accumulation of boundary layer material as the vortex sweeps along the boundary layer, yielding a mini-nebula which in turn can contract into a disk of layered convection with vortices at each of these boundary layers. Complete gravitational contraction of material in the vortices will yield planetary bodies whose direction of orbital angular momentum and rotation will coincide with that of the sun. Composition of a planetary body will be a mixture of that of the two convecting layers contiguious to the boundary layer of the body°s origin, hence planetary composition will vary radially. A variety of temperature, composition histories provides for the distances between each convection boundary layer. Assumption of steady state convective heat flow through the disk as a first approximation however requires Rayleigh numbers for each layer to be the same. These distances R(i) from the center of the disk (e.g., sun) to the boundary layers, e.g., the planetary bodies, is then such that

$$R(i) = cA^{i}$$

where all possible values of A are admissible. For instance, A=2 would apply to the solar system and could take on other values for satellites around the major planets. The potential for Soret convection across the boundary layers provides the possibility of interesting isotope and element variation between planets.