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The Transitional Model for the Earth's Mantle and the Chemical Geodynamics Paradigm

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Over the recent years an impressive number of new data came from the seismic tomography showing a dual geometry for slab penetration into the Earth mantle: some slabs penetrate the lower mantle, some slabs spread at the 670 km discontinuity. In addition to that several observations, both by seismic imaging and by harmonic analysis of gravimetric field, suggest the existence of a convective structure of the upper mantle distinct from the lower one. On the other hand, isotopic geochemical data including Sr, Nd, Pb, Hf and also He, Ne, Ar, Xe still support the two layer mantle models with some significant exchange between them. All of the approach developed with them: reservoirs, continental crust, upper mantle, lower mantle seem to be valid. The so called hidden reservoirs developed by Albarede's group on Hf geochemistry basis seems to be an artefact created by a wrong reference for Bulk Earth, the rare gases modeling or K/U ratios developed by the same group is totally in contradiction with Heat Flow data. All of the models developed on such kind of basis are irrelevant to data's. On the other hand, the heat flows data's specially when compared with ^{3}He flux still support the two layer mantle as suggested by O'Nions and Oxburgh. On the other hand, the careful comparative study of hot spot volcanism including multispace isotopic signature, volume considerations suggest the existence of dual origin of present days hotspots. The small ones come from 670km discontinuity, the big ones from the core-mantle boundary. This seems in agreement with seismic observations. An integrative model which explains all of the data's is to admit that, in the past, the Earth's mantle convected into two separated domains by the 670km discontinuity but since few hundred millions of years a whole mantle convection tends to initiate. Such transition between two layers when Rayleigh number is high to one layer when the Rayleigh number is lower is in agreement with experimental as well as numerical experiments modeling.