Chronometers and ages in early solar system materials.

J. L. BIRCK

Institut de Physique du Globe, 4, Place Jussieu, 75252 Paris Cedex 05 France; birck@ipgp.jussieu.fr

Recent instrumentation and improvements of existing techniques have largely extended the use of radio chronometers in the study of the early steps of planet formation. Among the long-lived or absolute chronometers, still only U-Pb has sufficient direct resolution to resolve some of the stages one from another. Among the numerous proven extinct radio activities there is a choice of temporal scales which should allow to address also the shorter episodes but with the drawback of being only relative chronometers. However a solid interconnection among these and to an absolute scale has still largely to be achieved. Normally this would be done on common well behaved primitive objects. Even when this is apparently the case as on the coupled chronometers Sm-147/Nd-143 and Sm-146/Nd-142, inconsistencies may appear [1]. It turns out that the figure of planet formation is extensively blurred by a rather long list of features which complicates the understanding of the connection between the physico-chemical processes leading to the present day planetary bodies.

Various levels of disturbance affecting differentially the various chronometers, may result from reheating, shock, aqueous alteration, exposure to galactic cosmic rays and finally secondary effects of the residence time on the terrestrial surface. The initial isotopic homogeneity which is a prerequisite to radiometric dating may also be questioned in primitive object displaying isotopic heterogeneity but this can be addressed on neighbouring isotopes of the same element if these exist like for Cr [2]. It appears necessary to make a sometimes subtle distinction between « date » and « age » as pointed out in a recent review of Y. Amelin [3] in the case of U-Pb dating,

Fortunately with the ongoing production of high precision isotopic results on an extended number of meteorites, abundant crosschecking of the data from the different chronometers should solve some of the most annoying inconsistencies. Nevertheless most results show that much of the history of the planets is written early in a very few million years and one of the most striking recent result is the evidence for almost simultaneous onset of magmatic differentiation at the My level with the production of the primitive refractory constituents.

References

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[2] Trinquier A. (2005) PhD Thesis Paris VII

[3] Amelin Y. (2006) *MAPS* **41,** 7-17.