Metal-rich chondrites : insights into the first steps of metal segregation

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The understanding of the very first steps of planetary formation and differentiation, in particular the processes and timing of metal-silicate partitioning, is crucial to apprehend the early evolution of planetary embryos. In this context, metal-rich chondrites are of special interest as they display evidence of incipient metal-silicate partitioning. Among radiochronometers, the short-lived ^{182}Hf-^{182}W isotopic system is ideally suited to establish the chronology of metal-silicate partitioning, but may be disturbed by alteration processes. To overcome this difficulty and still get useful chronological information from the ^{182}Hf-^{182}W system, we combined it with W mass dependent isotope fractionation in CR2 chondrites and Tafassasset, an anomalous meteorite possibly related to CR2 chondrites. We demonstrated that incipient melting occurred extremely early in the solar system, not only in relatively large parent bodies sampled by iron meteorites, but also in much smaller bodies such as the CR parent body. During this melting event, a basaltic component as well as a sulfur-rich metallic melt have been extracted. Besides, 3D-microtomography revealed that metal in the samples is interconnected and tends to form a 3D-network. Associated with mineralogical and petrological considerations, metal-silicate differentiation processes can be discussed as well as the role of percolation.