REE and Hf distribution among accessory phases in H and CK chondrites. Céline Martin[1], Vinciane Debaille[2], Pierre Lanari[3], Philippe Claeys[1] ,[1] Earth System Sciences, Vrije Universiteit Brussel, Belgium, [2] Département des Sciences de la Terre et de l'Environnement, Université Libre de Bruxelles, Belgium, [3] ISTerre-CNRS UMR 5275, Maison des Géosciences, Grenoble, France

Introduction:

This study presents the first comparative and systematic study of accessory phases modal abundances in ordinary and carbonaceous chondrites, coupled with trace-elements distribution among these phases.

Chondrites are among the most pristine objects of the Solar System and their average chemical composition estimates the initial composition of the Earth. Particularly, the Sm-Nd and Lu-Hf isotopic systems are used together as tracers of early planetary processes because they are not fractionated either by condensation/volatilization processes in the early Solar System or by metal/silicate separation during core formation in terrestrial planets. The CHUR (CHondritic Uniform Reservoir) serves as the established reference value for these two systems. It is clearly demonstrated that Sm-Nd values are well constrained and homogeneous in chondrites. However, recent data shows that this is not the case for Lu-Hf system that displays large Lu/Hf ratio heterogeneities (up to 28%), limiting its use in cosmo/geochemistry. At the moment, only values obtained on carbonaceous chondrites are homogeneous enough to define CHUR for Lu-Hf system, although Earth is likely a mixture between different types of chondrites. A wide overview of chondrites and the geological processes they underwent will ensure a better understanding of the first million years of the Solar System, including the early evolution of terrestrial planets and more importantly that of the Earth.

A detailed study of the trace-element (REE and Hf) distribution among accessory phases (metal alloys, sulphides, chromites, phosphates, iron oxydes) provides new data on the behavior of these trace-elements during chondrites metamorphism, and further allow to explain Lu/Hf ratio heterogeneities.

Trace-element contents in accessory minerals measured by electron microprobe (CAMPARIS, Paris, France) in H chondrites from type 3 to 6 and in CK chondrite from type 4/5 to 6 do not show any evolution (neither increasing nor decreasing) during metamorphism for a given accessory mineral.

Contrary to what is usually assumed, phosphates are not the main careers of REE in chondrites. Actually, all the accessory phases bear between 50 to 160 ppm of Nd, while Hf is mainly borne by sulphides and metal alloys whatever the H chondrite type. Iron oxides (primary or secondary (e.g. due to weathering)) bear up to 50 ppm of Nd and almost 40 ppm of Hf). In CK chondrites, sulphides, magnetite and phosphates are the only accessory phases. Once again, Nd is almost equally distributed among these phases (50 to 110 ppm), whereas Hf is mainly borne by magnetite.

Modal abundances of accessory phases will be obtained by combining very detailed mapping (3 μm step) by electron microprobe and using a dedicated software (Olivier Vidal, Terry Para and Pierre Lanari, ISTerre Grenoble) allowing to calculate mass balances and therefore to document the evolution of accessory phases during metamorphism as well as the evolution of trace-elements distribution. Moreover, such calculations compare modal abundances of accessory phases in ordinary chondrites (H class) and in carbonaceous ones (CK class).