Re – Os analyses at the CRPG-CNRS, Nancy

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Date visits:	first visit 18th – 30th of March; second visit 15th - 29th April
Days spend in CRPG-CNRS lab:	11 (first visit) + 11 (second visit) days
Travelling days:	4 days

During a first visit from the 18th until the 30th of March, 2012, and a second visit from the 15th until the 29th of April, 2012, we, Fienke Nanne and Thomas Meulemans, performed Re – Os analyses at the Centre de Recherches Pétrographiques et Géochimiques (CRPG-CNRS) in Nancy, France funded by a Europlanet grant.

Re-Os analyses were performed on mantle xenolith samples mainly taken from Botswana. The project was carried out as part of the Master of Earth Sciences and as a collaboration between European laboratories. The main question to be answered with the data collected during the project is when mantle melting first took place in the Archaean Zimbabwe Craton. This first melting event is expected to be related to the first crustal formation of the craton and hence can provide information on the evolution of the early Earth. A second important question is how much, if any, of the lithosphere beneath Zimbabwe was modified by subsequent magmatic events

The samples were from four different De Beers diamond mines: Orapa (6) and Letlhakane (18) mines in Botswana, Venetia (7) and Kimberley (1) mines in South Africa. This study represents the first Re – Os isotope data for peridotite xenoliths from Orapa and one of the first Re – Os isotope datasets for peridotite xenoliths from Letlhakane, which is why the main focus lies on the Botswana samples.

At the CRPG-CNRS, samples were digested in a high pressure asher (HPA-S), and Osmium was then extracted using procedures based on those outlined in Birck et al. (1997). Osmium isotopic compositions were obtained by the N-TIMS technique using a Finnigan MAT 262 mass spectrometer, while a NEPTUNE MC-ICP-MS was used for Rhenium analyses. With the excellent support from the people of the CRPG-CNRS, the chemical preparation of the samples was successful and efficient and many samples could be processed. Although the following Re concentration analyses took somewhat longer than the Os analyses, due to minor problems with the instruments, the data quality was excellent, with a 2σ error of <0.5% for almost all analyses.

The Orapa samples show two separate Rhenium depletion ages: one at ~2.9 Ga and one at ~1 Ga suggesting two events of mantle melting. The Letlhakane samples show a similar trend with Rhenium depletion ages of ~2.8 Ga and between 1 and 2 Ga. The Re-Os T_{MA} model ages determined relative to chondritic mantle were almost always geologically unrealistic except for one of the Orapa samples. That sample showed a model age of 1.25 Ga, which would coincide with first crystallization of this sample together with the first melting of other samples and metasomatism of the older samples. A summary of the model ages is presented in the figure below. These data will be the basis for further work and are expected to ultimately lead to a publication. The data obtained from Venetia complete an extensive study. An initial publication "**Lithospheric mantle stratification of the Limpopo Mobile Belt (South Africa) caused by Archaean continent-continent collision"** Quinten van

der Meer, Martijn Klaver, Tod Waight, Gareth Davies has been submitted to Lithos and a second paper is in the early stages of preparation.