Isotopic (Sr, Nd, Hf) composition of super-large metal deposits from the Kola penninsula using *in situ* LA-MC-ICPMS

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The Khibina and Lovozero massifs represent two of the world's largest complexes of layered peralkaline intrusions. They are located in the centre of the Kola peninsula and they are characterised by an extreme enrichment in volatiles (F, Cl, S), rare elements as well as alkalies. Previous investigation of whole rock Sr and Nd isotopic composition of the Khibina and Lovozero massifs demonstrated that the mantle source of these world's largest alkaline instrusions are significantly depleted [1]. The intrusions are characterised by the exceptional occurrence of unique Nd, Hf and Sr rich minerals. Apatite, rare metal loparite and eudyalite deposits occur in these massifs together with more complex minerals such as mosandrite, pyrochlor and belovite. The *in situ* Nd, Hf and Sr isotopic composition of these minerals has been measured throughout the layered instrusions using laser ablation MC-ICP-MS. The Khibina intrusion has a depleted isotopic signature with εNd, εHf and Sr isotopic values respectively at +4.2 ± 0.3 (2 σ), +8 ± 2.2 (2 σ) and 0.70365 ± 0.00004 (2 σ). Within the Lovozero intrusions, the εNd, εHf values and Sr isotopic values are slightly more radiogenic, respectively +3.2 ± 0.4 (2σ), +6.4 ± 2.3 (2 σ) and 0,70392 ± 0.0009 (2 σ). Alkaline rocks and ores of the Lovozero and Khibina rare metal deposits have a depleted mantle isotopic signature similar to OIB.

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New calibration of Raman Spectroscopy of Carbonaceous Materials (RSCM) geothermometer: Application in Aquitaine basin (France) and Gulf Coast (Texas)

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In this study we have calibrated the Raman Spectroscopy of Carbonaceous Materials (RSCM) geothermometer in the range 200-350°C.

For this calibration we have focused our effort on two main geological targets: the Helvetics nappes of Switzerland and the Franciscan complex of central California. Thermal history of these reference zones of low-grade metamorphism is well known thanks to the systematic combination of various techniques which are probably not perfectly reliable taken individually, but provides a robust estimate when they all converge. These methods include fluid inclusion thermometry, vitrinite reflectance, index mineralogy, illite cristallinity and low-T thermochronology, together with various thermal modelling. These two zones offer different geological context (collision vs subduction) and allow us to check the effect of various parameters such as geothermal gradient, organic precursor and deformation history.

To test the applicability of this new calibration of RSCM in the range 200-330°C, we analysed samples from different boreholes in Aquitaine basin of southwestern France and Gulf Coast of the United States.

Spectra of RSCM show variations with depth increase. The bands parameters (intensity, area…) evolve with temperature degree in the range 200-350°C.

RSCM temperatures concord with those calculated by using bottom hole temperature (BHT) and assuming a certain geothermal gradient.

To realize Raman analysis, we don't need to have a big amount of carbonaceous materials in the rocks.

RSCM geothermometer is a reliable method to constrain temperatures in the range 200-350°C. It constitutes a useful tool for a better estimate of the thermal history of rocks.