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Geochemistry and inner Earth

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Geochemistry is a powerful tool to study geological processes because it provides multiple constraints. The trace element composition of natural materials provides clues about their formation processes while isotopic compositions can be used to trace the origin of materials, their formation processes and their age. When focusing on the long-term evolution of the inner Earth, processes such as the onset of core, mantle and crust formation can be identified and quantified. Similarly, crustal recycling due to tectonic activity can be traced in the mantle source of volcanoes.

This talk reviews the present knowledge in the field but it mainly focuses on major advances related to analytical innovations and new concepts. For example, the advent of an increasing diversity of non-traditional stable-isotope studies provides new tools to study interactions between deep and shallow levels on the planet. Development of high-precision isotopic analyses leads to the recognition of patterns that could not be detected before and to the identification of early Earth differentiation processes: timing of core formation, composition of the complementary silicate earth reservoir, differentiation of early crust, etc.

When applying these isotopic tools to present-day mantle plumes, new evidence is found that material once present at the surface of the Earth is recycled to participate to the source of volcanoes. The presence of early Earth differentiation products is also detected in mantle plumes. All these observations raise the question of how and where ancient geochemical heterogeneities can be preserved in the deep Earth, opening new opportunities for close collaborations between geochemists, geodynamicists and geophysicists.