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Keynote 06: From magma oceans to solid mantles: experimental insights into the differentiation of terrestrial planets

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Planetary magma oceans were ubiquitous on terrestrial planets in the early Solar System and enabled their differentiation into a silicate mantle and an iron-rich core (metal-silicate differentiation). Over time, these large-scale magma oceans progressively solidified due to secular cooling, and their crystallization led to the formation of the main petrological and geochemical reservoirs in the mantle (magmatic differentiation). These two differentiation processes—metal-silicate and magmatic—are major planetary events that set the initial conditions of planetary bodies, and it is therefore essential to better constrain them.
To this end, the development of high-pressure experimental tools (such as large-volume presses and diamond anvil cells) since the mid-20th century has been a major advancement. On one hand, metal-silicate partitioning experiments conducted under core-formation conditions are used to infer the composition of planetary cores. On the other hand, crystallization experiments under conditions representative of the terrestrial mantle have helped us better constrain the solidification of Earth's magma ocean.

Speaker information

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Classification de Session: Probing the Deep Earth: Volcanoes, Primitive Earth and Planetary Cores