THE GEODYNAMICS SEMINAR Nº 574

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2021.6.17 (Fri.) 16:30 ~

Venue: Zoom
A link will be sent @grc-all within 30 minutes before the beginning of the seminar.

Redox disproportionation of Fe^{2+} in a deep magma ocean during core formation

Elucidating the redox state and its history of the earliest Earth's mantle provides key insights into the formation of the habitable environment (e.g., atmospheric and oceanic compositions) of the planet because the molecular composition of degassed volatiles from planetary interior is mainly controlled by the redox state of the mantle [e.g., 1, 2].

Despite the reducing nature of terrestrial magma ocean during core formation, geological evidence shows that the early Earth's upper mantle around 4 billion years ago (so called Hadean eon) may have already been oxidized close to today [3]. This indicates that the earliest Earth's mantle had experienced a great oxidation event. To explain the great mantle oxidation after the core formation, the redox disproportionation of ferrous iron (Fe^{2+}) to ferric iron (Fe^{3+}) plus metallic iron (Fe^{0}) in a magma ocean has been proposed [1, 4]. In this hypothesis, the redox state of the magma ocean increases after the removal of metallic iron into the core. Here I show new experimental results that show the formation of highly oxidizing magma ocean via Fe^{2+} disproportionation. In this seminar, I will also discuss implications of our experimental results for the redox state of the Earth's magma ocean and Hadean mantle.

References:

[1] Hirschmann, 2012, Earth and Planetary Science Letters 341-344, 48-57.

[2] Gaillard and Scaillet, 2014, Earth and Planetary Science Letters 403, 307-316.

[3] Trail et al., 2011, Nature 480, 79-82.

[4] Armstrong et al., 2019, Science 365, 903-906.