# Transformation kinetics for olivine with ~75 ppm $H_2O$ into ringwoodite

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## Metastable Olivine Hypothesis

The existence of metastable olivine (MO) has been debated as a possible trigger of deep focus earthquakes, but of equal importance its existence may constrain the amount of hydrogen being brought to Earth's mantle transition zone (MTZ) via subduction. The rate which olivine (ol) transforms into wadsleyite and ringwoodite (rw) is dependent on hydrogen content, and determines the likelihood that metastable olivine could persist into the MTZ. Previous results indicate that 300 ppm of $H_2O$ is too much to allow for MO [1, 2]. How much is too much? We present rw rim growth rates for olivine containing as little as 75 ppm of $H_2O$.

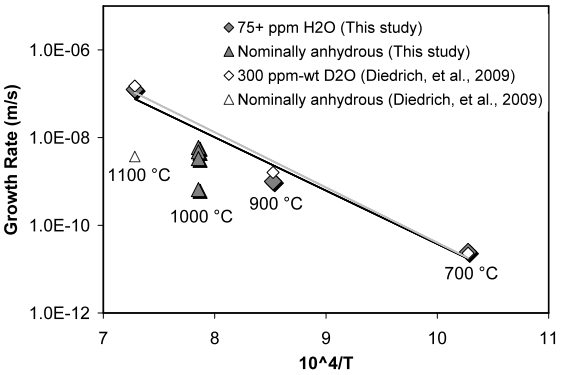


**Figure 1:** Rw rim growth rates for ol containing 75+ ppm $H_2O$, 300 ppm $D_2O$ [1], and nominally anhydrous.

## Discussion of Results

Rw rim growth for ol containing ~75+ ppm of $H_2O$ intially occurs at a rate that is nearly identical to that of olivine containing 300 ppm $D_2O$. In the earliest stage of growth, 75 ppm of $H_2O$ is enough to partion into the growth rim and hydrolytically weaken it, but was not enough to sustain a linear growth rate into completion transformation. We do not see proposed power law dependence on hydrogen content of this range, or grain size (500 μm) [3].

[1] Diedrich *et al*. (2009) *Chem Geol* **262**, 87–99. [2] Kubo *et al*. (2009) *EPSL* **287**, 12–23. [3] Hosoya *et al*. (2005) *GRL* **32**, L17305.

# Turnover of stable organic carbon and $CO_2$ evolution from soils applied with fresh organic matter

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As deduced from the literature, the soil organic carbon (SOC) of particle size <53 μm is mineral-associated organic carbon (MAOC), a measurable fraction of the stable pool described in the CENTURY terrestrial model.

We studied the effect of fresh organic matters (FOM): no OM (control); chicken manure (CM): 2.12 g carbon $kg^{-1}$ soil; and leaf litter (LL) compost: 1.81 g carbon $kg^{-1}$ soil on short-term dynamics of MAOC and $CO_2$ evolution of two soils: Bagabag, Nueva Vizcaya, Philippines (121°15'E, 16°35'N) and Tsumagoi, Gunma Prefecture, Japan (138°30'E, 36°30'N) in a 110-day constant temperature laboratory incubation experiment.

Bagabag soil had higher cumulative $CO_2$ evolution and $CO_2$ evolution rate than Tsumagoi soil despite the former having lower initial SOC content, contrary to conventional knowledge that soils having higher initial SOC content have higher rate of SOC loss than soils with lower SOC levels. Significant MAOC decrease in 5–20-cm layer of Tsumagoi soil suggest short-term stable SOC turnover in a timescale of days. Greater MAOC decline in CM-applied Bagabag soil suggest that manure application may result to bigger stable C turnover in this soil. Our results provide evidence of short-term stable SOC turnover, and challenge the convention that only labile SOC is involved in short-term $CO_2$ evolution from soils applied with organic matters.

[1] Dumale (2009) *Geophys. Res. Lett.* **36**, LOI301: doi 10. 1029/2008GL036436.