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Thermodynamic Price Tags for A Wet Mantle

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The exciting discovery of Wadsleyite as mineral host for hydrogen or as a 'hydrous material' in the mantle has redox-equilibria-implications relative to other published redox models for the Earth's mantle. Such redox models for the Earth's mantle suggest that along the geotherm, shallow mantle conditions range from the log fO_2given by the buffer (FMQ) to levels of redox of Δ(FMQ) = -2. These models have been based on studies that include: (1) xenolith studies by several methods(as reviewed by Ulmer *et al.*, 1987) (2) stability of diamonds relative to other redox buffers (for example, Eggler and Baker, 1982 or Ulmer *et al.*,1978). Most redox models for the Earth's mantle do incorporate more reduced conditions for greater depth in the mantle: the log fO_2given by the buffer (IW) at the core mantle boundary is one logical reason for this model. Deeper xenolith studies also suggest this. (Haggerty and Tompkins, 1983 or Ulmer *et al.*, 1987). Even more reduced conditions for the mantle are implied by the abundant existence of the mantle mineral, Moissanite, (SiC) whose redox stability in log fO_2can be represented byΔ(IW) $\approx$ -8 at pressures up to 9.0 GPa and temperatures up to 1730 K. Furthermore, the kinetics of oxidation of SiC exposed to carbonates or iron oxides from 2.0 to 15.0 GPa and temperatures as low as 1173 K has been measured in hours, not days or months ! (Ulmer *et al*., 1998)

To have mantle phases, either with hydroxyl, or as true hydrates, that can be compatible in the redox state of the mantle seems a problem ? A companion manuscript at this meeting explores redox EOS calculations of water stability in the mantle. (*cf.*, Woermann *et al.*). To our thinking, one possibility may be the influence of defects in the Wadsleyite. No direct data yet seem available for this suggestion; it is by analogue to the large range of redox values demonstrated by defect olivines that this idea should

be pursued.

REFERENCES:

Haggerty, S. E., and Tompkins, L..(1983), Redox State of Earth's Mantle from Kimberlitic Ilmenites, *Nature* **393**,295 - 300.

Ulmer,G.C., Woermann, E. Knecht,B., and Rosenhauer, M. (1978), The role of pressure on redox buffers. *EOS Trans. AGU*, **59**, 398.

Ulmer , G.C, Grandstaff, D.E., Weiss, D., Moats, M.A., Buntin, T., Gold, D.P., Hatton, C., Kadik, A., Koseluk,R.,Rosenhauer, M. (1987) The Mantle Redox state: an unfinished story? GSA Special Paper 215, *Mantle Metasomatism and Alkaline Magmatism*, eds., E.M. Morris & J. D. Pateris, 5-24.

Ulmer, G.C., Grandstaff, D.E., Woermann, E., Schönitz, M., Göbbels,M., and Woodland, A. (1998), The redox stab-lity of Moissanite (SiC) Compared to Metal/Metal Oxide Buffers, *NJB fűr Mineralogie, abH*. **171**, 2/3, 279-307