**Ocean Science
Discussions**

Interactive comment on "Salinity/temperature ranges for application of seawater S_A-T-P models" *by* G. M. Marion et al.

Anonymous Referee #1

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I am happy to see this paper published for although it is not a major breakthrough it is a very competent attempt to see how classic solution chemistry concepts for mineral equilibria will change as CO2 levels rise. I only have small comments and suggestions.

It is difficult to offer very detailed comment without downloading the model and testing it, and thus one has to rely on the word of the authors. But two things caught my eye as in need of better explanation for readers:

1. "the FREZCHEM model selects the solid phase that minimizes the Ca (or other ion) concentration as the most thermodynamically stable mineral. "CaCO3" as defined in Eq. 3 is the only solid phase in the FREZCHEM model that is allowed to persist at the supersaturated level before precipitating. On the other hand, coping with the

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degree of supersaturation associated with Eq. 3 required that we remove several carbonate minerals from the FREZCHEM mineral database, including aragonite (CaCO3), vaterite (CaCO3), dolomite [CaMg(CO3)2], magnesite (MgCO3), and hydromagnesite [3MgCO3Mg(OH)23H2O]. These minerals, except for aragonite that is a factor in Eq. 3, do not precipitate from seawater despite their supersaturation. Retention of the latter carbonate minerals in FREZCHEM would lead to their precipitation rather than the supersaturated "CaCO3" as defined in Eq. 3. As pointed out above, "CaCO3" likely represents either aragonite or calcite."

I think this is a practical programming step, but this is a geochemical paper, and the readers should have a little more explanation as to why this is mechanistically valid.

2. "Heterogeneous nucleation in the presence of CaCO3 minerals will reduce the applicability range of SA-T-P models. Unfortunately, the data to place a broad range on heterogeneous nucleation is relatively limited. Fortunately, homogeneous nucleation (Fig. 2) is more realistic for the bulk of Earth seawater."

I rather doubt that this statement is true. Homogeneous nucleation does carry an energy penalty for induction, and it is very hard for me to believe that natural sea water does not contain a vast number of nucleation sites on the various and ubiquitous clay particles, microbes, planktonic debris, POC etc. It doesn't really affect the paper - but I suspect that the concept of pure homogeneous nucleation is an illusion.

Interactive comment on Ocean Sci. Discuss., 6, 171, 2009.

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