UC **SANTA BARBARA**

Department of Earth Science

Speakers Club

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Development of new thermodynamic model calibration software: Applications to a new 7-component garnet solid solution model

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Garnets can accommodate cations with a wide range of size and charge allowing for stability over a wide range of P-T-X conditions. Thus, garnets capture significant petrological, geochemical, and geochronological information during their growth history. To date, there are 4 garnet solid solution models that can be implemented in igneous phase equilibria calculations covering the ternary garnet system, pyrope ($Mg_3Al_2Si_3O_{12}$), grossular ($Ca_3Al_2Si_3O_{12}$), and almandine ($Fe_3Al_2Si_3O_{12}$), with one considering a 4th endmember, spessartine ($Mn_3Al_2Si_3O_{12}$). Unfortunately, these models are in poor agreement with each other in terms of garnet crystalline solution thermodynamics and cover limited compositional space compared with natural garnets. This work aims to formulate a new, 7-component garnet solid solution model to be implemented in igneous thermodynamic modeling software, like MELTS (Ghiorso et al., 1995). Traditionally, the formulation and implementation of new thermodynamic solution models into phase equilibria models has been extremely time consuming and not always well-documented. The large number of researchers utilizing thermodynamic models for phase equilibria computation like MELTS, Thermocalc, MCS, or Perple_X, have relied on a small group of professionals to develop and update them as new data become available. Thus, in addition to formulating a new garnet solution model, new model calibration software is also being developed to automate and make more accessible to the petrological and geochemical community, the formulation and implementation of new thermodynamic solution models.

Late Cretaceous crustal shortening in the northern Snake Range metamorphic core complex: Constraints on the structural geometry and magnitude of pre-extentional footwall burial.

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Cordilleran metamorphic core complexes (MCCs) of the Basin and Range province are locations of high-magnitude extension recognized by the striking juxtaposition of strained mid-crustal metamorphic rocks and highly-faulted supracrustal rocks along a gently-dipping extensional detachment fault. Though widely studied as natural laboratories for crustal extension processes, many, if not most, Cordilleran MCCs preserve an earlier history of Mesozoic crustal shortening and thickening that pre-dates extension. Metasedimentary rocks exposed in MCC footwalls previously resided at shallow crustal levels, and, based on P-T estimates, underwent localized Mesozoic burial to 2-3X their original stratigraphic depth, in sharp contrast to neighboring equivalent units that remained in the upper crust. The northern Snake Range (NSR) metamorphic core complex of east-central Nevada provides an exceptional opportunity to characterize Mesozoic shortening structures and provide models for crustal shortening/burial associated with the Sevier Orogeny. This study presents new detailed mapping and structural data characterizing the Mesozoic O'Neill Peak recumbent syncline (OPRS) and Eightmile thrust system (EMTS) exposed within the footwall of the NSR. The geometry of these structures are used to create plausible reconstructions of the Sevier hinterland prior to Tertiary extension.