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SOME NEGLECTED THERMOPHYSICAL PROPERTIES OF PLATE MATERIALS AND THEIR WIDER SIGNIFICANCE

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PHASE CHANGES. Geophysical treatments of thermal subsidence, doming or uplift usually refer solely to the thermal expansivity of silicate rock. If it is found that not enough heat can have been conducted in, it is common to invoke advective introduction of the heat (e.g. delamination, plumes). Similarly, in the case of ocean floor subsidence, measured heat flow out to 50-60Ma is less than half what the observed subsidence would require with pure thermal contraction, so hydrothermal extraction of heat has been invoked. Solid-state phase changes, e.g. spinel-to-garnet peridotite, are, however, an inescapable consequence of cooling or heating the mantle and are enormously (>10x) more efficient at converting joules to volume change.
LOW VELOCITY ZONE (LVZ). It now seems that up to ~3% interstitial melt can be held without migration, so volcanism should not be regarded as a foregone conclusion. Water partitions strongly into the interstitial melt so the water-weakening of the mineral fabric is removed, possibly making the LVZ more resistant to creep than if no melt were present (Karato 1986). This contradicts the perception that the LVZ is, by definition, a mobile zone. The thermal conductivity of silicate melt is at least 10x less than that of upper mantle minerals, lowering LVZ thermal conductivity by up to 30%, so thermal gradient in an immobile LVZ will be markedly superadiabatic, affecting temperatures throughout the mantle.

Here I will suggest in outline how to accommodate the impact of these matters upon the interpretation of Earth behaviour, and aim to do so in more specific detail in other symposia at this meeting.