

## Silicate melting in the Earth's deep upper mantle caused by C-O-H volatiles

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The onset of silicate melting in the Earth's upper mantle influences the thermal evolution of the planet, geochemical differentiation of the interior, flux of key volatiles to the exosphere, and geophysical properties of the mantle. Although the first initiation of melting beneath mid oceanic ridges likely produces dry carbonatite melt as deep as ~350 km, owing to vanishingly small volume (~0.03%), its effect on geochemical and geophysical properties of the mantle is unclear. Geophysical data, however, suggest possible presence of partial melts to depths exceeding 200 km. Silicate melts have better prospects in this respect owing to higher viscosities and densities; however, they are not thought to be generated at depths approaching or in excess of 200 km. Here we present experiments in natural peridotite+CO<sub>2</sub> systems over 2 to 5 GPa and constrain the location and the slope of the onset of silicate melting (melts with ≤25 wt.% CO<sub>2</sub>) in a carbonated mantle. We show that the P-T slope of transition from carbonate to silicate melt is steeper than the solidus of volatile-free peridotite owing to diminishing non-ideality of mixing between carbonate and silicate melt components as a function of pressure. This causes carbonated silicate melting of dry peridotite beneath ridges to commence as deep as ~230 km. Taking into account 50-200 ppm water in the nominally anhydrous mantle and its effect on freezing point depression, the onset of silicate melting for a sub-ridge mantle with ~100 ppm CO<sub>2</sub> becomes as deep as ~260-300 km. Deep carbonated silicate melting can deplete the mantle from its water storage capacity, to match the depleted mantle water content beneath ridges. Deep onset of silicate melting also restricts the stability of carbonatite in the Earth's deep upper mantle and the inventory of carbon and other highly incompatible elements at ridges becomes almost entirely controlled by flux of deep, wet carbonated silicate melts.

Finally, deeper transition from carbonatite to carbonated silicate melts causes the melt CO<sub>2</sub> to be diluted at greater depths than previously modeled. This causes graphite to carbonated melt transition depth beneath continents to be deeper than recent estimates.

## SHRIMP U-Pb geochronology of Neoproterozoic Rio Una sequence, NE Brazil, and the Rodinia break-up

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The amalgamation of Gondwana resulted from the fragmentation of Rodinia and the reassembly of the cratonic blocks during the Neoproterozoic. The Borborema Province is the western part of a major Brasiliano belt that extends from Brazil through NW Africa in pre-drift reconstructions. This province results from the convergence and collision among the West African, Congo-São Francisco, and Amazonia land masses about 600 Ma. The Rio Una Sequence is located within the PEAL Domain of the Borborema Province. It is comprised by 3 units. We are presenting U-Pb dating of the unit 1. This unit comprises migmatized metapelites with peraluminous mesosome (andaluzite-, cordierite-, garnet-bearing biotite gneisses), with quartzites intercalations. The studied sample was collected near one of these intercalations. The analyzed sample shows zircon grains with length ranging from 80 μm up to 200 μm. They are elongate to rounded zircons, with aspect ratio ranging from 1:1 to 2:1. They usually show oscillatory zoning, and in some case a narrow metamorphic overgrowth. The <sup>232</sup>Th/<sup>238</sup>U ratio of almost all analysed grains ranges from 0.20 to 2.16, suggesting that they come from an igneous protolith, or from a recycled igneous rock. The U-Pb data with less than 5% discordance cluster mostly in the intervals 850-1100 Ma and 1800-2100 Ma. The data points that the unit 1 show a maximum depositional age of 854 Ma. The age of this sequence is coeval with the age attributed to the beginning of the Rodinia break-up.