Melting of peridotite to 140 GPa

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Melting phase relations and major elements partitioning have been determined for a fertile peridotite (KLB-1) between 36 and 140 GPa. The experiments were conducted in diamond-anvil cells at the high-pressure beamline ID27 of the European Synchrotron Radiation Facility (ESRF) so as to use clear in situ melting criterion and to determine phase relationships from X-ray diffraction. Focused ion beam (FIB) sections of the recovered diamond-anvil cell samples were further investigated at the nano-scale by scanning and analytical transmission electron microscopy to check melting/crystallization sequences as well as variations of phase composition with temperature and pressure. Our results show that Mg-perovskite is the liquidus phase above 50 GPa, whereas ferropericlase is the solidus phase. Our results also yield strong constraints on the solidus curve of the lower mantle, which is measured at 4180 ± 150 K at core mantle boundary pressure. Since this value matches estimated mantle geotherms, molten regions may exist at the base of the present-day mantle. Melting phase relations and element partitioning data show that the produced liquids could be dense and host many incompatible elements at the base of the mantle. Such a melt could indeed segregate from the crystalline solids and accumulate at the core mantle boundary over time as fertile material passes through the boundary layer. Incompatible elements might accumulate in such a partial melt, and further add excess heat production to the melt piles at the base of the mantle. The data also allow us to constrain the way the putative magma ocean would have crystallized. The change in melting phase relations observed between 40 and 60 GPa indicates that a perovskite rich layer may be created in the mid-lower mantle during crystallization of this magma ocean whereas dense liquids having both a higher iron content and a higher oxide/perovskite content could sink to the core mantle boundary.

GIS based spatial distribution mapping for surface waters in Solaklı Basin (Trabzon, Turkey)

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Shortage of clean ground water to satisfy the need for drinking-potable water of increasing human population is one of the most significant problems encountered in today's world. On the other hand, surface water is contaminated due to lack of sufficient conservation. This study aims at revealing the current status of surface and groundwater in Solaklı (Trabzon) Basin by means of physical and chemical investigation. Quality assessment parameters are determined at 33 points in the basin with 2 points selected for groundwater and 31 points selected for surface water quality assessment. A Geographical Information System (GIS) tool was used to construct thematic maps for surface water quality in the Solaklı Basin. Water chemistry data were integrated and overall picture about the spatial variation in the surface water quality of Solaklı Basin was defined. While the amounts of the chemical components found in natural waters basins in don't vary considerably throughout the basin, amounts of pollutant parameters such as NO_2, NO_3 and PO_4 increase depending on the discharge of settlement areas. Surface waters in Solaklı basin are classified as high quality for many parameters according to criteria designated in Inland Surface Water Classification. Surface waters are classified as polluted water in terms of the Cu and NO_2^- values. Amounts of Mn and Ni in the Solaklı basin groundwater using as potable water for Of Town are found to be above Turkish Drinking Water Standards.