Boron isotopic composition of borosicates from the Larsemann Hills, East Antarctica

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Boron enriched grandidierite±kornerupine±tourmaline assemblage occur in high-grade pelitic gneisses from the Larsemann Hills,East Antarctica. Indentifying the palaeogeographic setting can be difficult in the high-grade metamorphic terranes,where the effects of metamorphism may obscure most primary depositional features.Here we report boron isotope data for borosilicates from the Larsemann Hills,East Antarctica.The lightest $\delta^{11}B$ values (-10.6 to –34.6‰) were found in borosilicates.These very light $\delta^{11}B$ values were most compatible with boron derivation from non-marine evaporite borates. We suggest that the isotopically light boron at Larsemann Hills may have been derived from non-marine evaporites,as this is the only known reservoir containing sufficently light boron to explain the borosilicates $\delta^{11}B$ values.

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Seismic tomography and mantle heterogeneities – A view from mineral physics

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Seismic tomography provides direct observations on lateral velocity variations in the mantle. However, it is difficult to differentiate effects of lateral temperature variations from heterogeneities in seismic tomographic images. With detailed mineral physics modeling, we are poised to establish certain criteria in distinguishing thermal effects from composition effects. P-V-T equation of state data are now available on virtually all major mantle minerals. Acoustic velocity data on mantle minerals, which contain critical information on shear properties at high pressure and temperature, are emerging from ultrasonic experiments. Combining these data with phase equilibrium information, we perform forward modeling on certain composition models to examine three factors that may influence lateral density and velocity variations: temperature, composition, and phase. While lateral temperature fluctuations and certain elemental distribution (e.g., Fe partitioning) are characterized by the $d\ln V_S/d\ln V_P$ and $d\ln V_S/d\ln\rho$ ratios that vary symmetrically relative to an average (reference) mantle, phase transitions tend to skew velocity variations and the scaling ratios. In fact, phase transformations often result in dramatic density and velocity variations, whose associated apparent $d\ln V_S/d\ln V_P$ and $d\ln V_S/d\ln\rho$ ratios may vary significantly and cannot be understood by temperature derivatives alone. The akimotoite-garnet transition, for example, produces large velocity increases and high apparent $d\ln V_S/d\ln\rho$ and $d\ln V_S/d\ln V_P$ ratios in hotter regions of the transition zone, because akimotoite is stable at relatively low temperatures and has much higher acoustic velocities than garnet. Effects of elemental distribution and phase assemblage are frequently coupled. An increase in Al content causes the garnet field to expand by lowering the akimotoite stability temperature in the transition zone and by increasing the perovskite formation pressure in the lower mantle. Thus Al content plays an important role in placing the akimotoite-garnet phase boundary relative to the geotherm. We will present our recent mineral physics modeling and discuss implications of the results.