Effect of partial melting on compressional wave velocities of crustal rocks

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Compressional wave velocities (VP) at above-solidus temperatures and at 1 GPa were obtained for an granite and amphibolite, which are considered to be major constituents of the continental crust. The present results, together with estimated geotherms corresponding to the heat flow values, the low velocity zones within the continental crust could be caused by partial melting of granite and amphibolite.

Compressional wave velocities (VP) at above-solidus temperatures and at 1 GPa were obtained for an granite and amphibolite, which are considered to be major constituents of the continental crust. The temperature variation of velocities showed that the VP values of granite decreased with raising temperature, but substantially increased beyond the melting temperature. Such an increase may be caused by the phase transition of quartz. The present results, together with estimated geotherms corresponding to the heat flow value, beneath the southern Tibet, suggest that the thickening of the felsic crust would lead to raise the temperatures within the crust sufficient to cause partial melting, resulting in a thin low velocity layer.

The velocities of amphibolite decreased linearly with increasing temperature and dropped sharply at temperatures above the solidus, indicating that partial melting of amphibolite acts to significantly lower the seismic velocities. Taking the density of the crust into account, the low average seismic velocities beneath central Andes, could be explained by the presence of partially molten amphibolite, which is probably originated from basaltic magmas underplated at the base of the crust.