

Melting of recycled crust responsible for the Gutenberg discontinuity

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A discontinuity in the seismic velocity associated with the lithosphere-asthenosphere interface, known as the Gutenberg discontinuity, is enigmatic in its origin. While partial mantle melts are frequently suggested to explain this discontinuity, it is not well known which factors critically regulate the melt production. Here, we report geochemical evidence showing that the melt fractions in the lithosphere-asthenosphere boundary were enhanced not only by accumulation of compacted carbonated melts related to recycled ancient marine sediments, but also by partial melting of a pyroxene-rich mantle domain related to the recycled oceanic eclogite/pyroxenites. This conclusion is derived from the first set of Mg isotope data for a suite of young petit-spot basalts erupted on the northwest Pacific plate, where a clearly defined G discontinuity exists. Our results reveal a specific linkage between the G discontinuity beneath the normal oceanic regions and the recycling of ancient subducted crust and carbonate through the deep Earth.