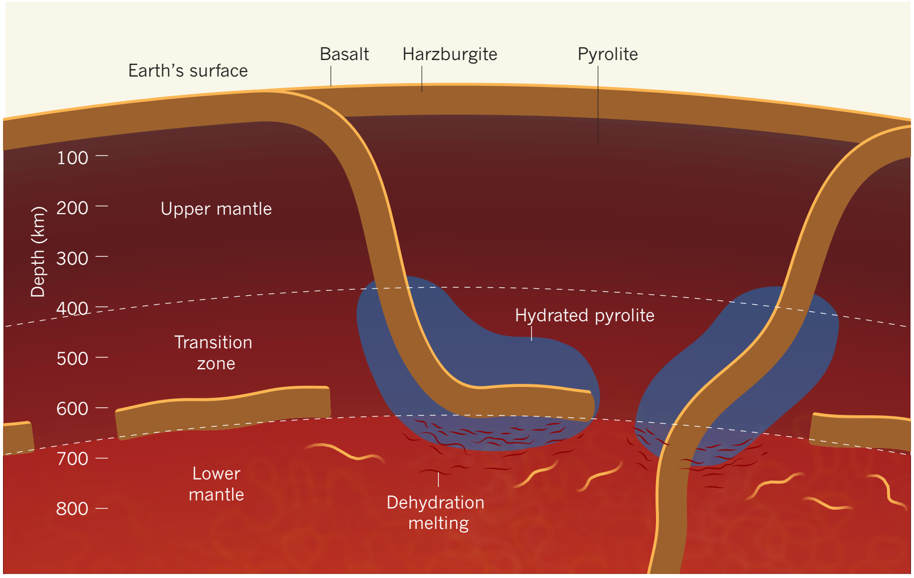

Figure 1 | Current theories for the recycling of oceanic crust in Earth's mantle. Slabs of oceanic crust (which is formed mainly of a rock called basalt) and underlying mantle rocks (harzburgite) sink into Earth's mantle, which is often modelled as being formed from a hypothetical rock called pyrolite. Basalt accumulates within and beneath the transition zone between the upper and lower mantle. In downwelling regions, hydrated rocks in the transition zone are pushed into the lower mantle, where they release water bound in their minerals. The resulting aqueous fluids can trigger melting. This dehydration melting could explain[10,11] why seismic waves have low velocities in some regions at depths greater than 660 kilometres. Gréaux *et al.*[2] report that basaltic rocks in the mantle will also have slow seismic waves. The presence of basaltic rocks at depths greater than 660 km could therefore be an alternative explanation for the low seismic-wave velocities in these regions.

600 kelvin, and this cubic form is probably adopted at the high temperatures present in the mantle. However, the crystal structure of CaPv spontaneously distorts to a tetragonal form at lower temperatures. CaPv must therefore be held at high temperatures and pressures to determine the physical properties of the cubic phase.

In their experiments, Gréaux *et al.* synthesized CaPv, and analysed both the cubic and the tetragonal forms at high pressures and temperatures in a high-pressure apparatus. They measured the time taken for ultrasonic waves to travel through the CaPv at different pressure–temperature combinations, and irradiated the samples with intense X-rays to generate images and diffraction patterns. By combining these measurements, the authors derived sound-wave velocities and elastic moduli (which quantify the resistance of a solid material to small, non-permanent deformations) for CaPv.

Gréaux and colleagues found that the shear modulus of cubic CaPv, which specifically measures the resistance of the mineral to reversible deformation caused by distortions (shear deformation), is substantially lower than estimates[5,6] calculated using first-principle computations. The difference reflects the fact that the computed sound-wave velocities were significantly higher than those measured in the experiments. The experimental findings highlight the importance of assessing the elastic and acoustic properties of mantle minerals at relevant pressures and temperatures that, in the case of CaPv, would stabilize the cubic form. The authors went on to use the new data for cubic CaPv to improve estimates of the velocities of seismic waves travelling through rocks in Earth's mantle.

The boundary between Earth's upper and lower mantle is marked by steep gradients in density and seismic-wave velocities at depths of around 660 kilometres. The pressures and temperatures thought to prevail at this depth coincide with major changes in the mineral assemblage of pyrolite — the hypothetical rock that is often used as a model for the rocks that constitute the bulk of the mantle. These mineral transformations increase the density of pyrolite, so that basaltic materials become buoyant at depths of between 660 km and 750 km (refs 4, 7, 8). Geodynamic simulations[9] show that the sequence of density changes in this region can effectively trap recycled oceanic crust.

Gréaux and colleagues' results suggest that seismic waves travel much more slowly through recycled oceanic crust than through pyrolite at depths of between 660 km and 770 km. Consequently, the authors propose that the presence of trapped basaltic rocks could explain the reduction of seismic-wave velocities that has been observed locally at these depths (Fig. 1). The reduction was previously attributed[10,11] to deep dehydration melting — the process in which water is released from the crystal structures of hydrous minerals, causing melting. The report last year of the discovery[12] of a fragment (an inclusion)

50 Years Ago

Later this year, in November, *Nature* will be a hundred years old. For much of the century, the journal has contributed in several unrelated ways to the development of science. From the beginning, of course, it has been a professional journal, but at the beginning it was most especially a means by which the still small and informal profession of science could be kept aware of events within and of pressures from outside. The early volumes of *Nature* contain an entirely readable mixture of opinion, news — particularly the doings of universities, learned societies and observatories — and occasionally of argument … For a great many years, the correspondence from readers was largely concerned with natural curiosities … Only by the turn of the century did the correspondence columns become a vehicle for the announcement of important discoveries in science.

From *Nature* 11 January 1969

100 Years Ago

The Saxon State Railways are now submitting their engine-drivers and other responsible train officials to certain tests in their psychometric laboratory at Dresden … [T]he tests comprise strength of will and endurance, and fatigue where there is physical strain. The Dubois ergograph is used for the purpose, the object being to trace a fatigue curve. The forearm rests on the table; over the middle finger is run a catgut loop, which passes over a pulley, the other end of the gut supporting a weight of from 4 to 8 kg., according to the suitability of the subject. When the middle finger is bent the weight is raised, and when relaxed again the weight is dropped, the process of this motion being traced on a recording drum … The system has been said to give satisfactory results as regards the selection of men for the proper posts.

From *Nature* 9 January 1919