# Experimental seismic velocity profile of the Martian mantle

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**Résumé**

**Decades of scientific explorations have gathered a vast quantity of data on the Martian atmosphere and its surface geology. While Martian meteorites suggest its interior is rich in iron, the available geochemical and geophysical data have not been sufficient to constrain the composition, mineralogy, and internal structure of the Martian mantle. In this study, we experimentally investigate the elastic wave velocities of two different iron-rich pyrolite-type compositions (with Fe# = Fe/(Mg+Fe) of 0.17 and 0.27) at high-pressure and temperature. By using a multi-anvil apparatus we are covering a range of possible conditions for the Martian mantle, between 3 and 17 GPa. The velocity profiles obtained for iron-rich pyrolite (Fe#0.27) exhibit three major seismic discontinuities at 620, 880, and 1130 km depths, corresponding to the transformation of olivine to a mixture of olivine and ringwoodite, then to a mixture of wadsleyite and ringwoodite, and finally to a mixture of ringwoodite and ferropericlase. For pyrolite-type with Fe#0.17, we only observe a velocity discontinuity at 980 km of depth induced by the transformation of olivine to wadsleyite. Our results demonstrate that Martian mantle likely to be composed of at least two layers, an olivine-rich layer from the crust to 1000-1100 km depths, and a second layer composed of wadsleyite and majoritic garnet down to least 1300 km depth. The eventual presence of a deeper ringwoodite-rich layer depends on the mantle temperature.**

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