The composition of meteorites, density of the Earth, and seismic velocity measurements allow us to constrain the composition of the mantle.

In addition, the mantle is sometimes exposed in orogenic belts, at the base of ophiolites, and in oceanic fracture zones.

Pieces of mantle are also sometimes carried to the surface as xenoliths in volcanic eruptions.

From these combined observations, we conclude that the mantle consists of peridotite (olivine-rich rock). Specifically, ‘fertile’ mantle peridotite should be lherzolite.

Peridotite Nomenclature
Most of the upper mantle should consist of lherzolite: olivine, orthopyroxene, and clinopyroxene plus an aluminous phase.

**Upper mantle mineralogy**

- At lowest pressure (<30 km), the aluminous mineral is plagioclase (CaAl$_2$Si$_2$O$_8$).  
- At intermediate pressure (30-60 km), the aluminous phase is spinel (MgAl$_2$O$_4$).  
- At high pressure, the aluminous phase is garnet (Mg$_3$Al$_2$Si$_3$O$_{12}$)
Lherzolite Mineralogy and Composition

![Lherzolite Mineralogy and Composition](image1.png)

Harzburgite–Melt depleted Peridotite

![Harzburgite–Melt depleted Peridotite](image2.png)