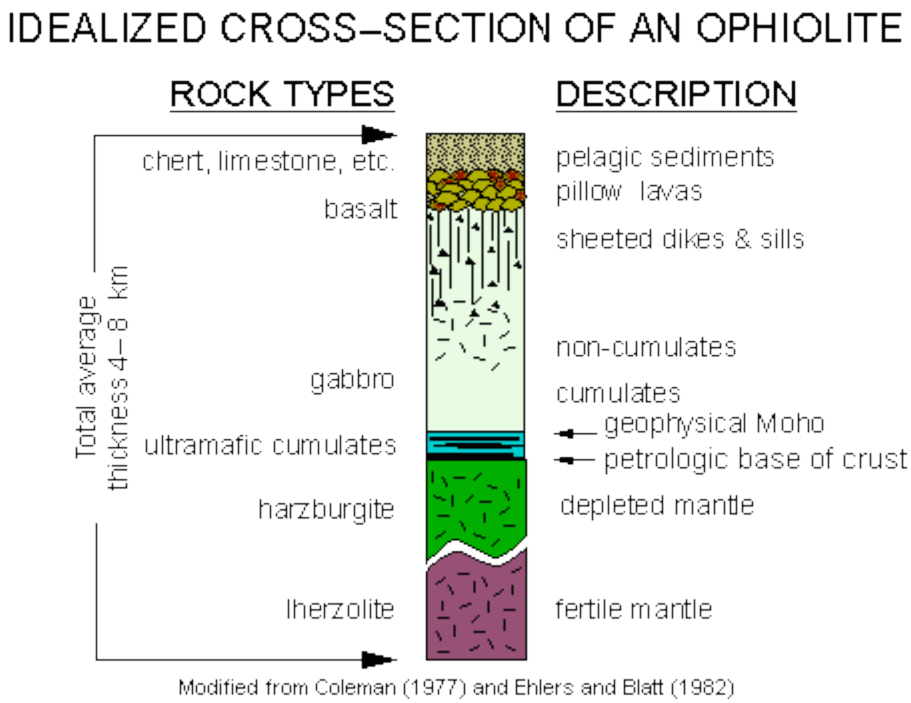
THE OPHIOLITE SEQUENCE

An oceanic spreading ridge is an area of rifting where two oceanic plates are being forced apart by addition of new magma from below. These areas can be located at major crustal plate boundaries such as the mid-Altlantic Ridge (separating the North American Plate from the Eurasian Plate), or in back arc basins such as parts of the Japan Sea. The types of rocks which form at spreading ridges are strongly influenced by both igneous and metamorphic processes. These regions are mixing zones, where both solids (lavas) and fluids from the Earth's crust and mantle interact with seawater, resulting in extensive low temperature and low pressure alteration (prehnite-pumpellyite facies metamorphism) of existing minerals and precipitation of new ones. These areas are particularly important in terms of understanding the formation of some ore deposits!

The characteristic assemblage of rocks which form at spreading ridges is called an **ophiolite sequence**. The typical rock types are illustrated below, and include ocean sediments, mafic extrusive and intrusive igneous rocks, and ultramafic rocks.

These rocks commonly have a metamorphic sole or base (not shown), which is thought to have formed during emplacement of the sequence onto continental lithosphere. These sequences are commonly revelaled in areas characterized by accretionary tectonics, such as the western margin of North America.



The top of the ophiolite sequence consists of fine grained, ocean sediments (cherts, lime mustones, etc.). Below this are pillow basalts, which form when hot magma is extruded onto the ocean floor. These rocks are often extensively altered by interaction with seawater. Sheeted or intruded dikes occur below the pillow basalts. These dikes represent the feeders to the subaqueous pillow basalts, and typically intrude consecutively into one another before cooling is complete. Underlying the basalts is a layer of its intrusive equivalent - a gabbro. The upper part of the gabbro is typically not stratified, but the basal part of the gabbro commonly contains cumulate layers. The cumulates were the first formed crystals which sank to the base of the chamber. The base of the gabbro layer, where the cumulate gabbro passes into an ultramafic cumulate, marks the geophysical base of the crust known as the Moho. Here the density contrast causes a marked attenuation in seismic velocity. The petrological contact between the earth's crust and the mantle, lies at the base of this ultramafic layer. The harzburgite layer at the top of the mantle is considered "depleted" - it is composed of only orthopyroxene and olivine, and lacks the typical clinopyroxene and spinel of the underlying fertile mantle rocks (the lherzolite).