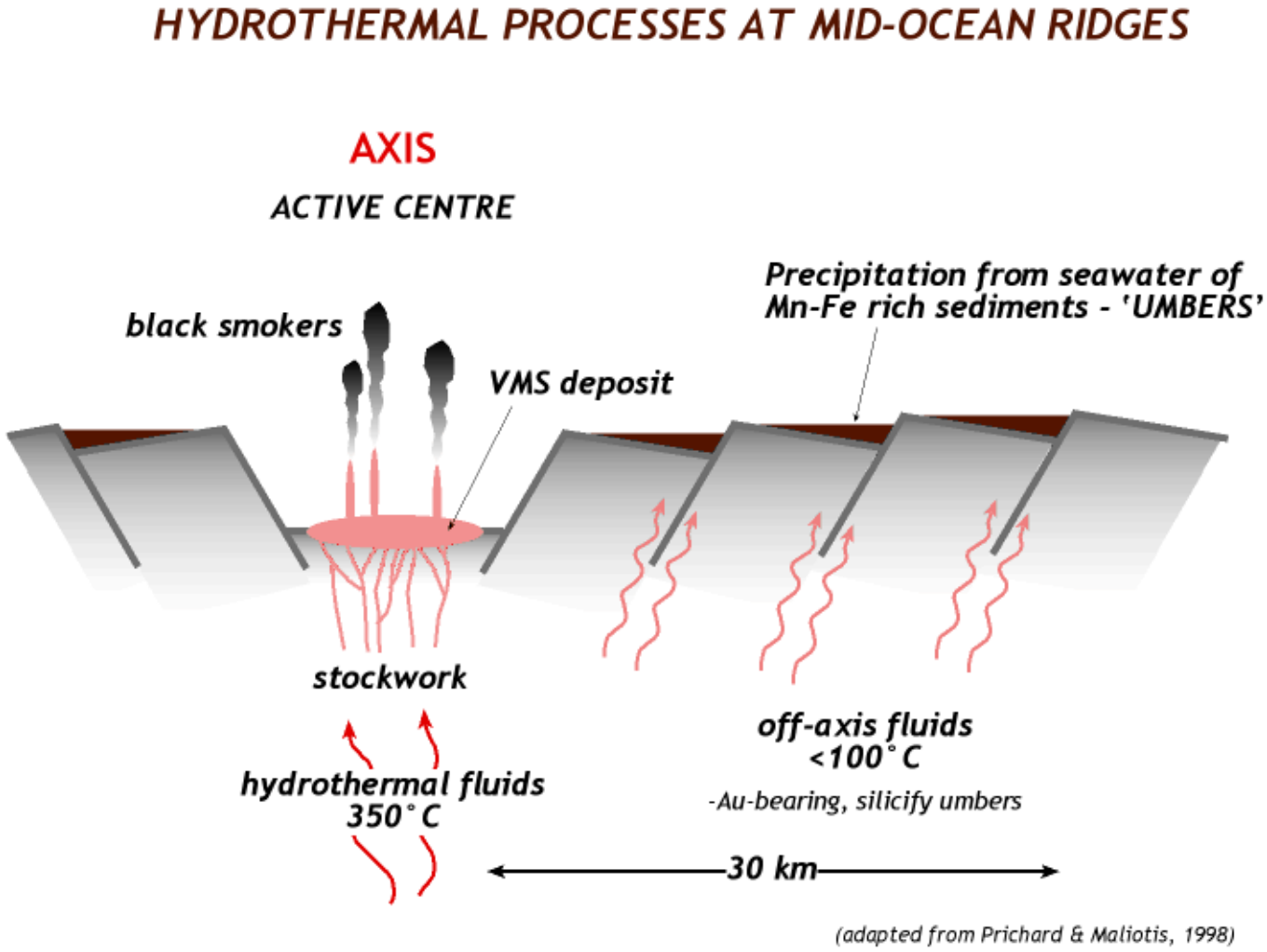
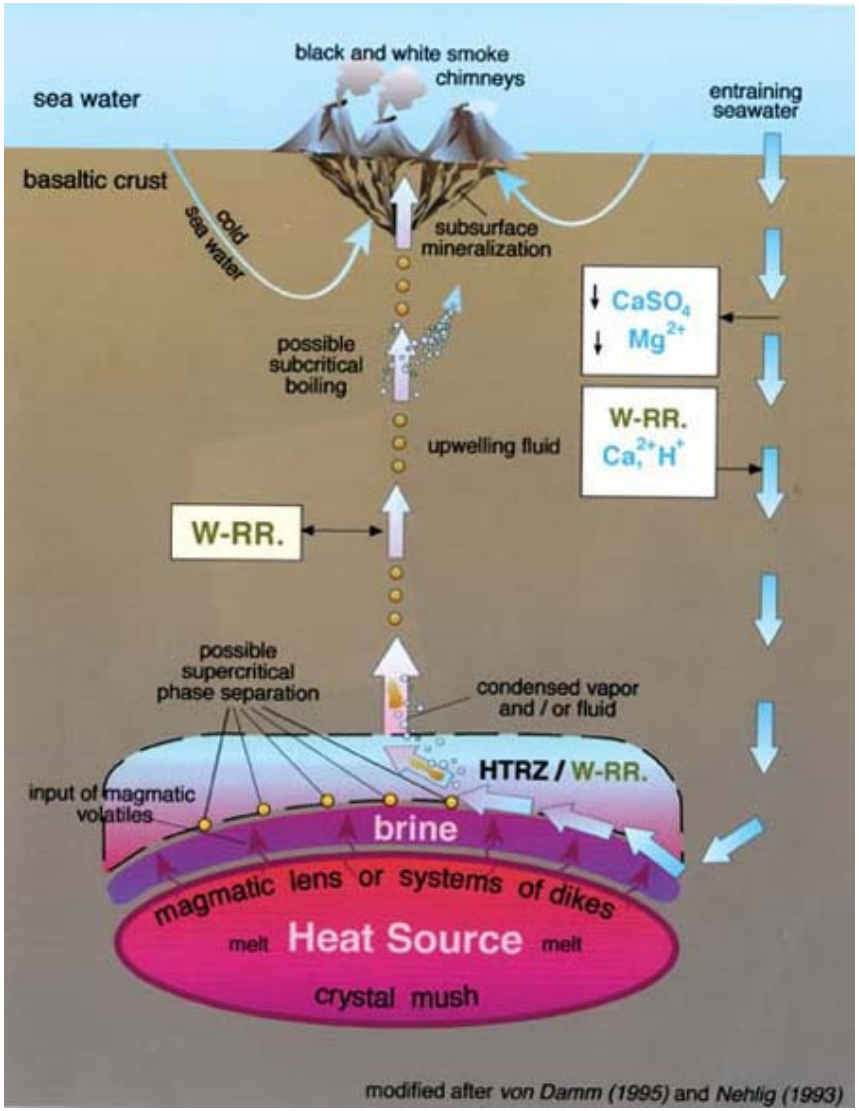
Hydrothermal activity

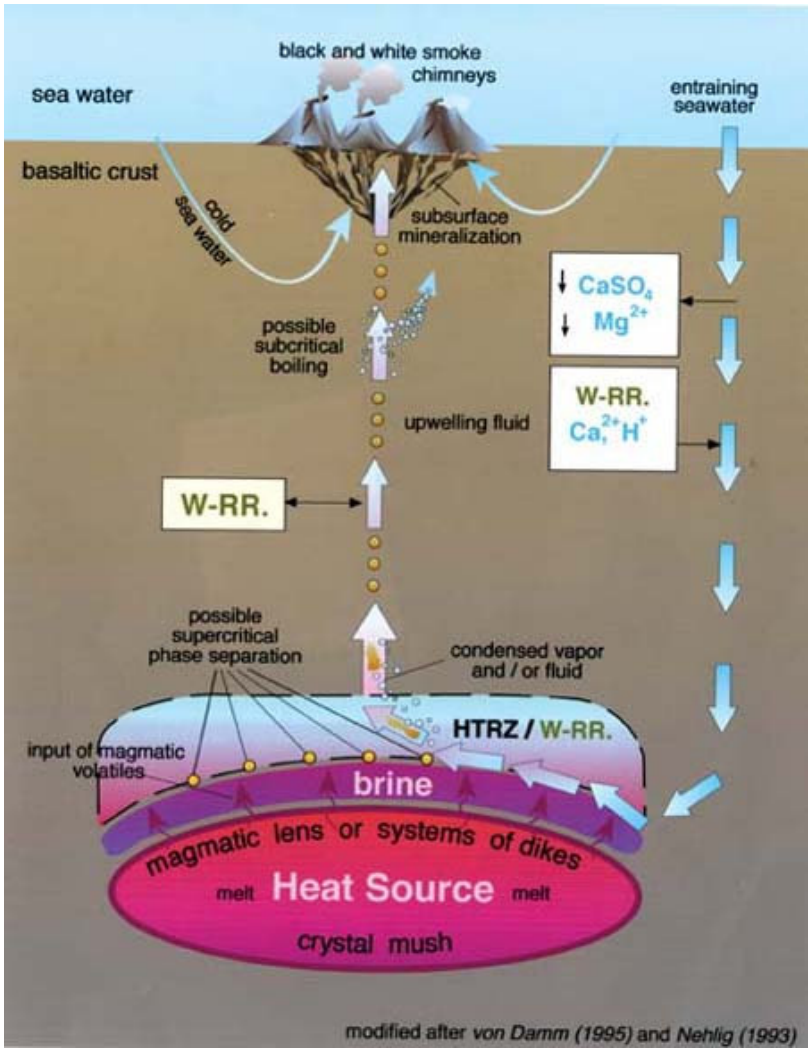


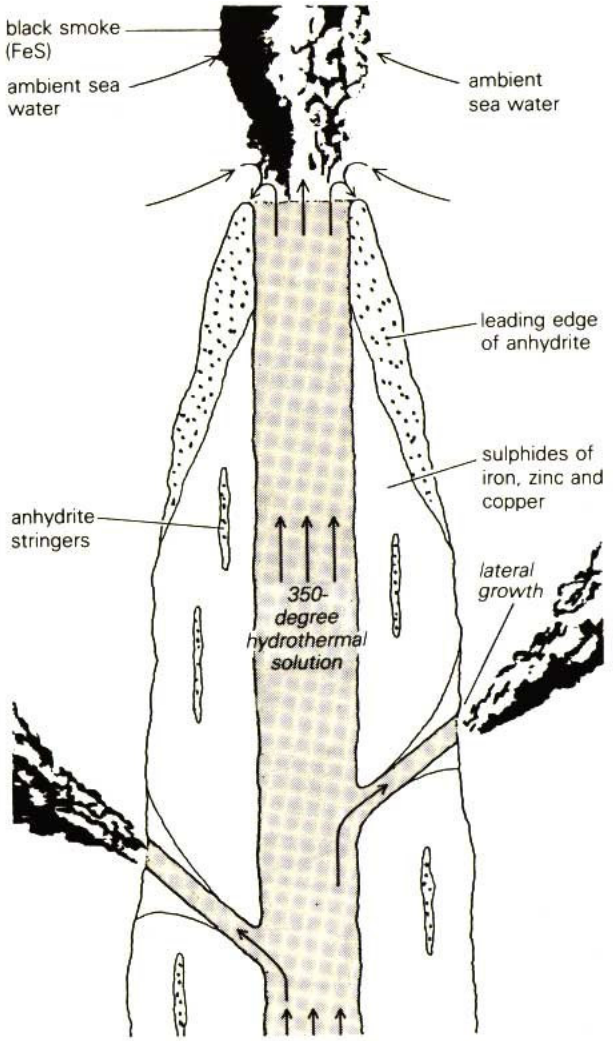
Hydrothermal circulation at mid-ocean ridges



After sea water seeps into the crust, Ca, sulfate, and Mg are removed from the water. As the water begins to heat up sodium, potassium, and calcium dissolve from the crust. Magma superheats the water, dissolving metals like iron, zinc, copper, and sulphur. The water then rises back to the surface, where it mixes with the cold seawater, forming black metal-sulphide chimneys.

Hydrothermal circulation at mid-ocean ridges

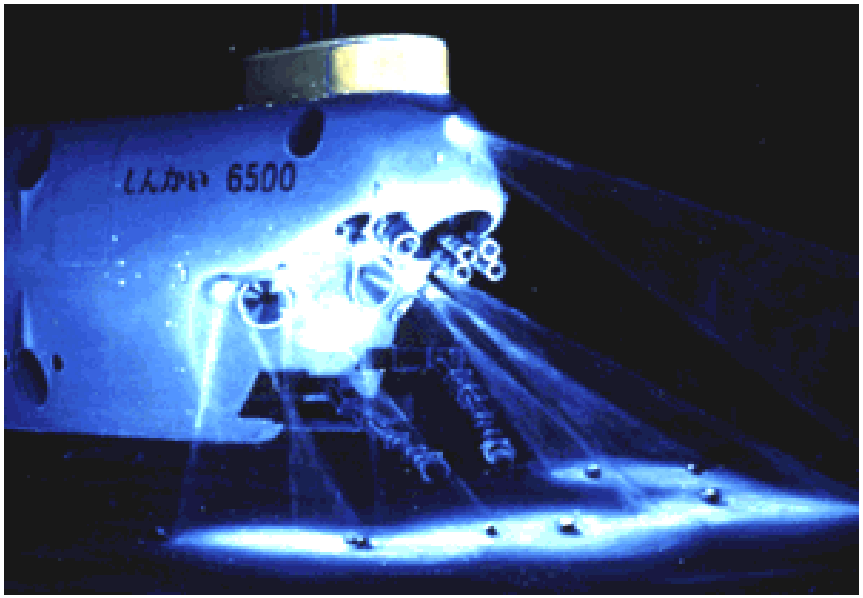




Black-smoker

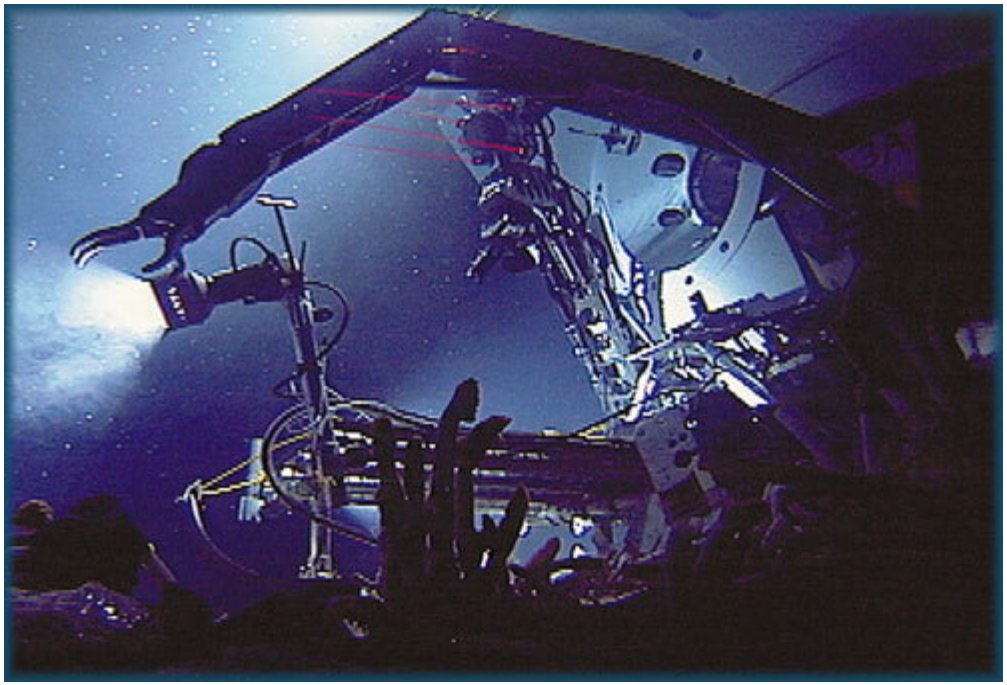
Schornsteine am Meeres-grund

Deep-sea submersibles

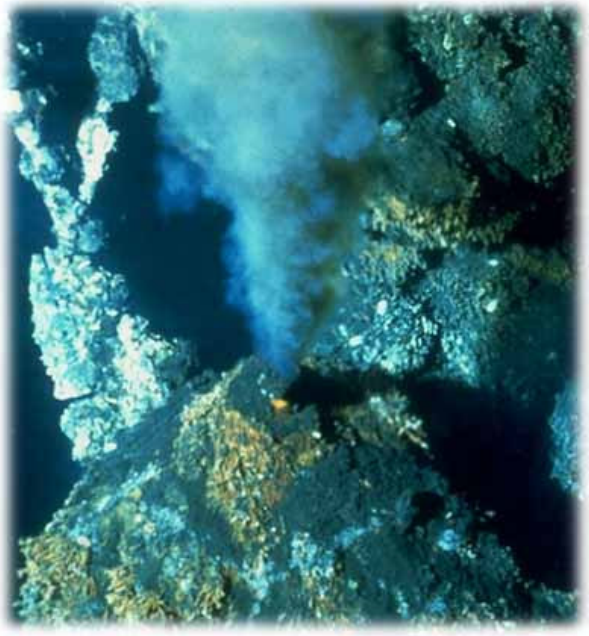


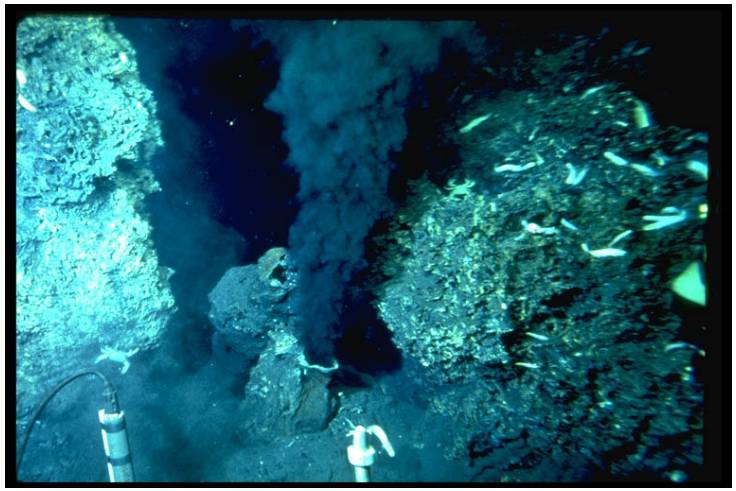
Shinkai 6500

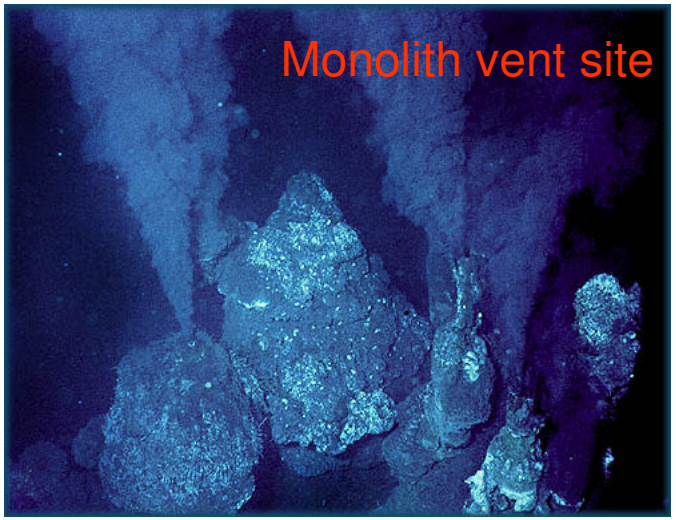
Alvin



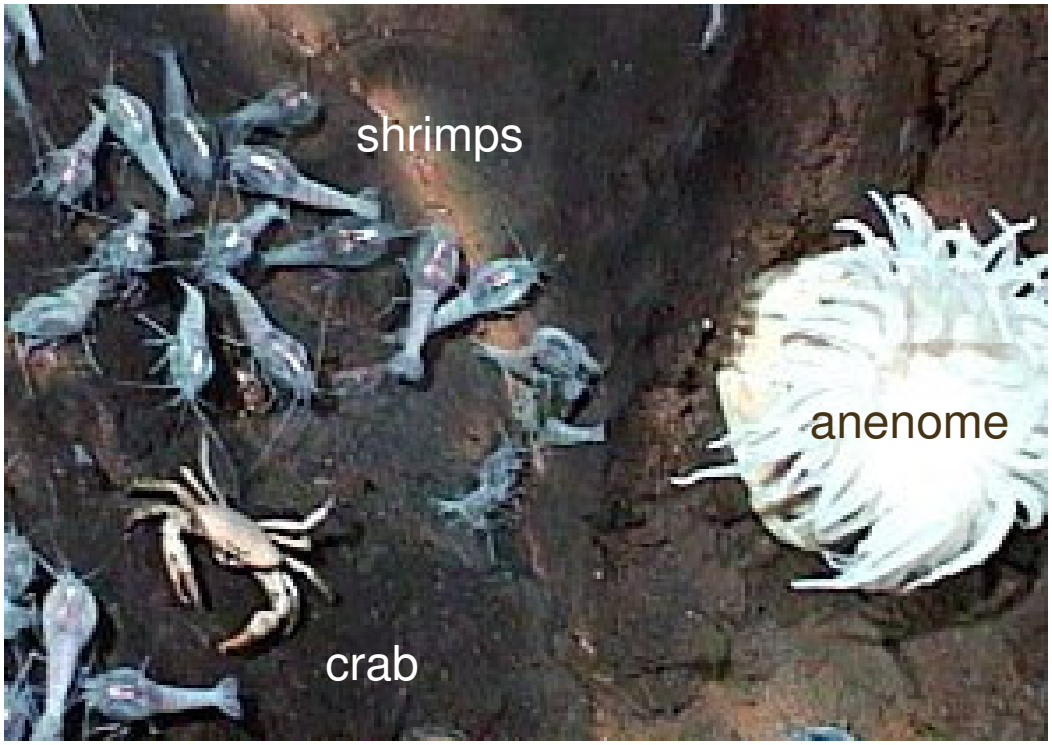
The deep-sea floor







A new Indian Ocean vent



Bacteria

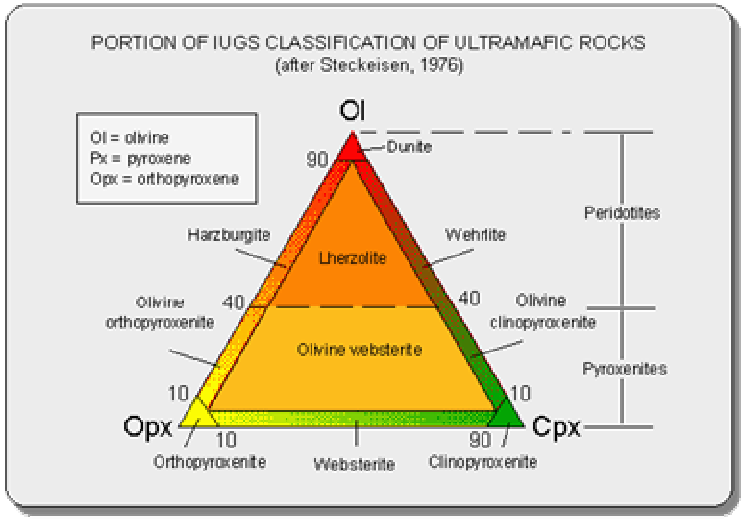
Chemosynthesis:

$6CO_2 + 6H_2O + 3H_2S \rightarrow C_6H_{12}O_6 + 3H_2SO_4$

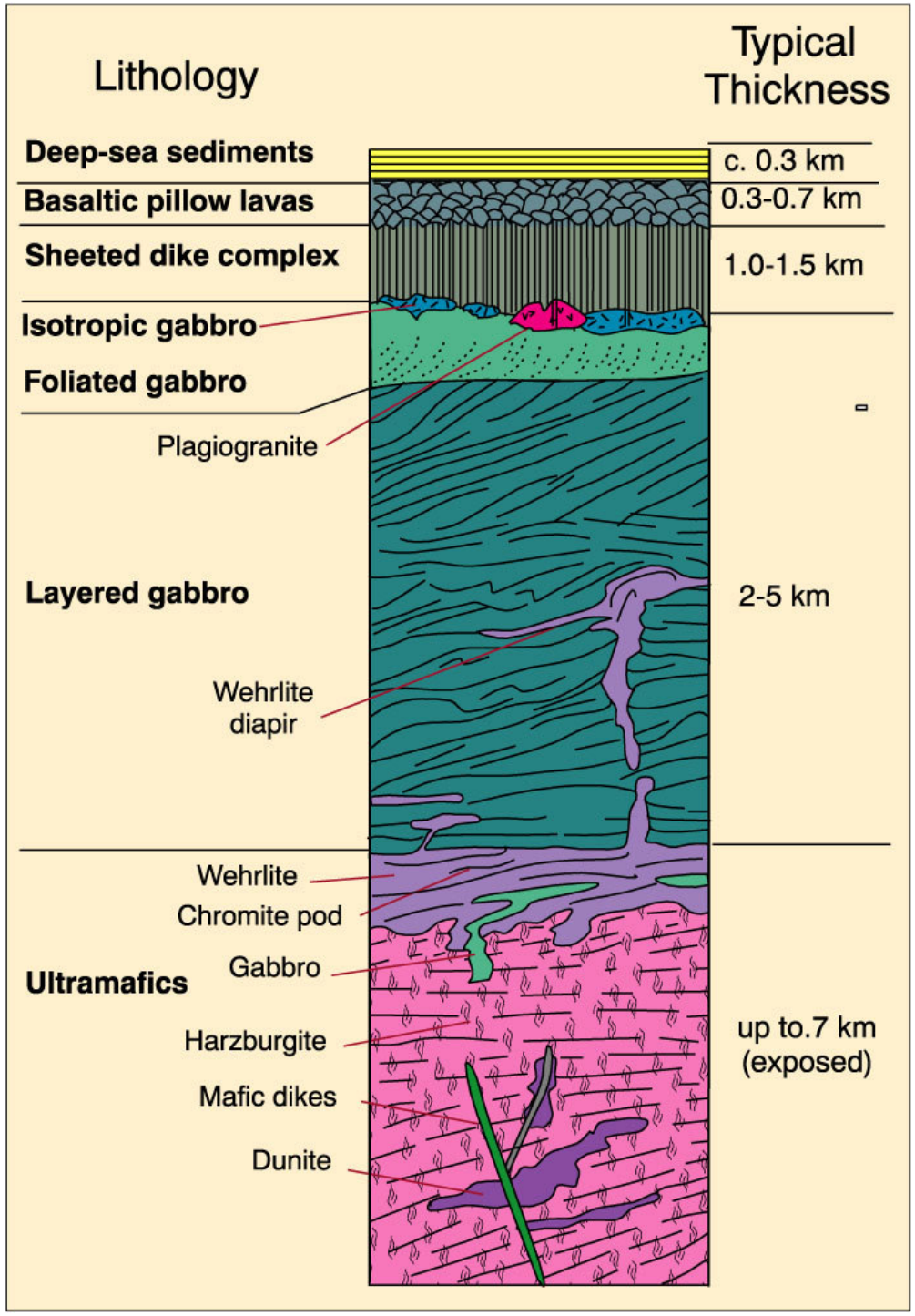
Oceanic Crust and Upper Mantle Structure

- 4 layers distinguished via seismic velocities
- Deep Sea Drilling Program
- Dredging of fracture zone scarps
- Ophiolites

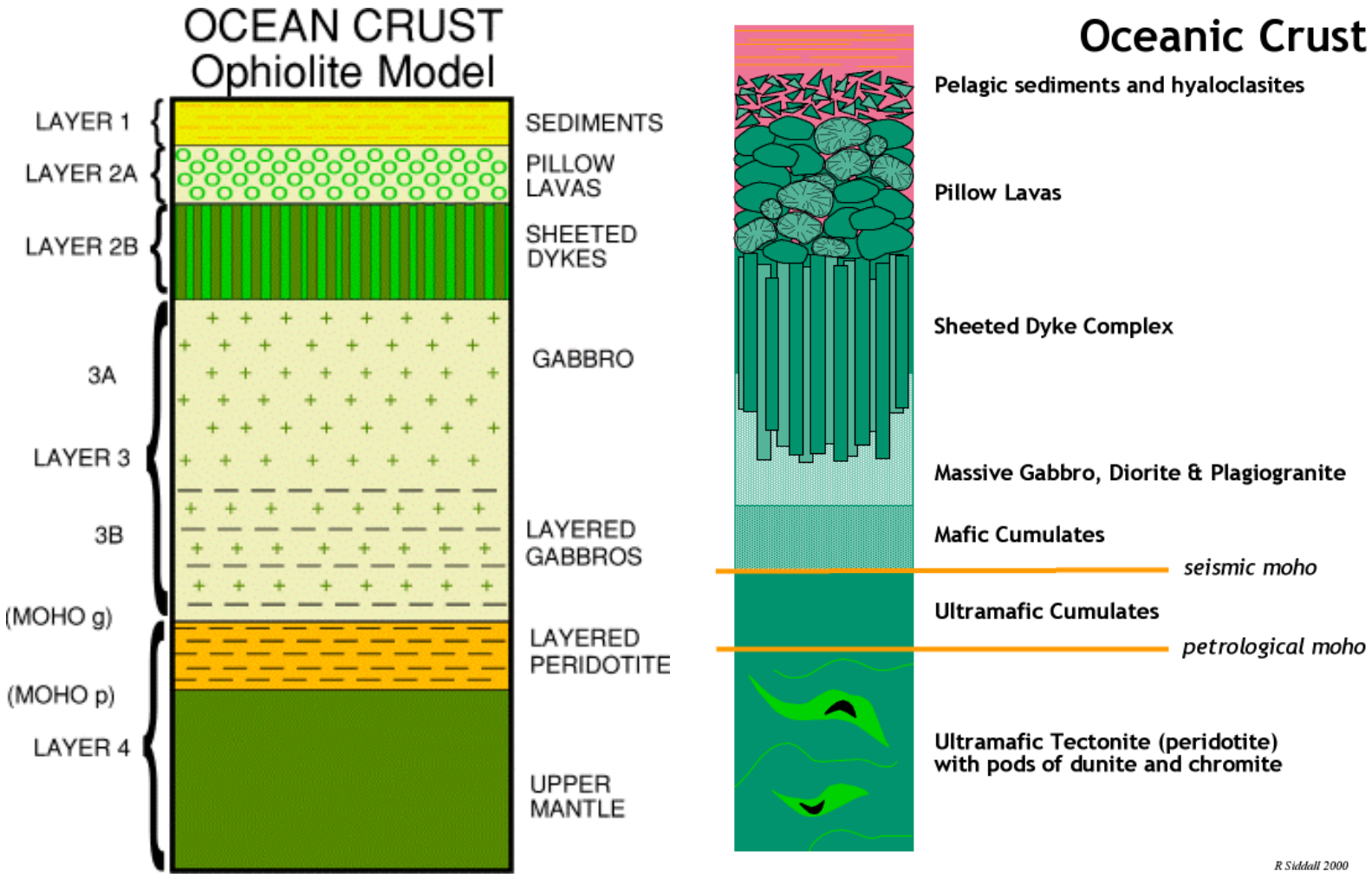
Oceanic Crust and Upper Mantle Structure



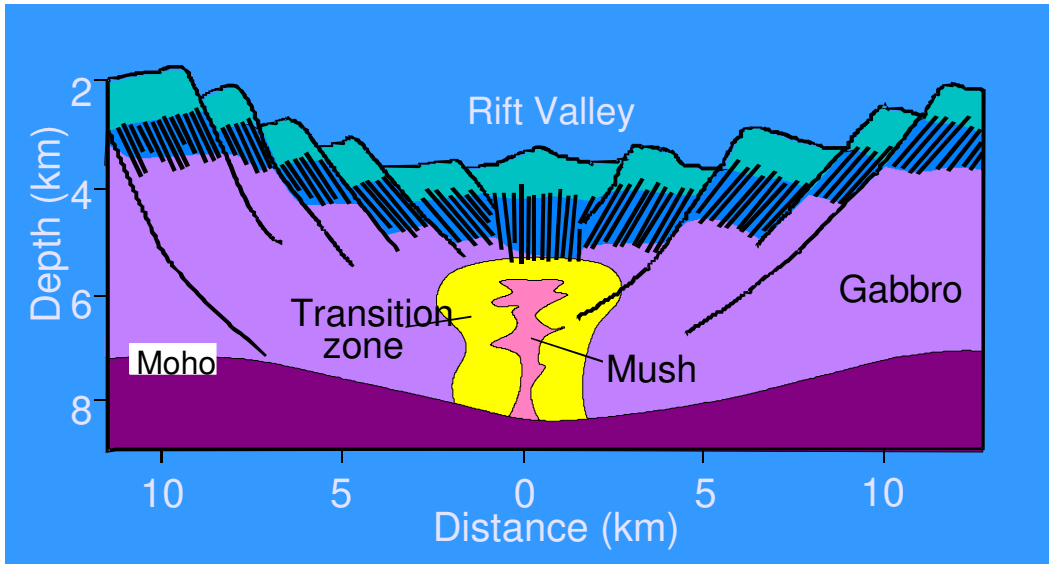
Lithology and thickness of a typical ophiolite sequence, based on the Samial Ophiolite in Oman. Boudier and Nicolas (1985) Earth Planet. Sci. Lett., 76, 84-92.

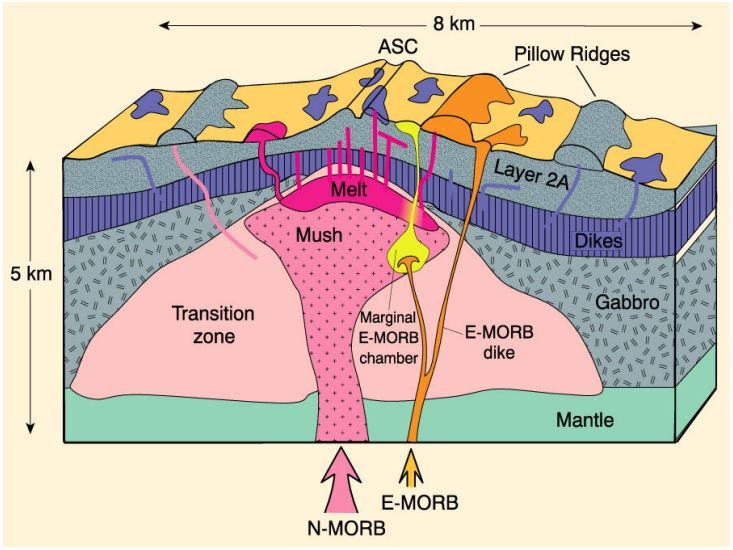


Idealized ophiolite sequence



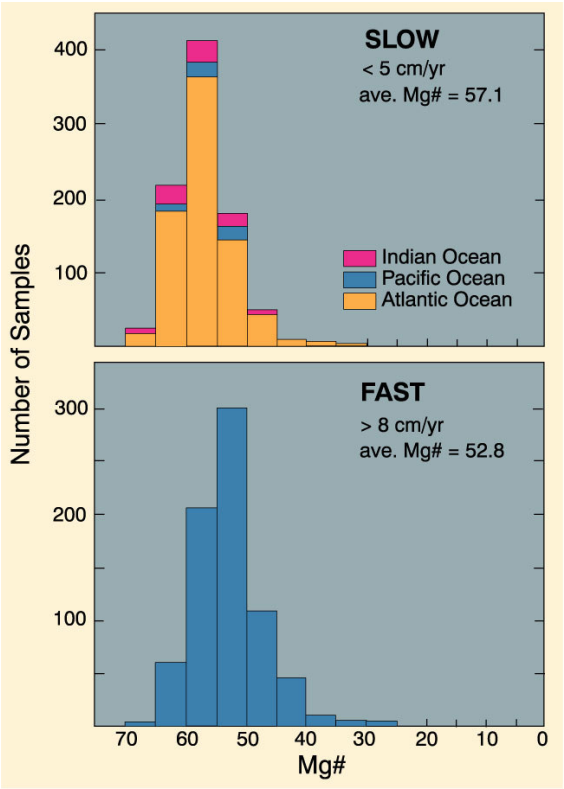
Spreading rate and magma composition





Sinton & Detrick (1992) J. Geophys. Res., 97, 197-216

Perfit et al. (1994)
Geology **22**, 375-379



- Slow ridges are generally less differentiated than fast ridges. No continuous liquid lenses, so magmas entering the axial area are more likely to erupt directly to the surface hence more primitive, with some mixing of mush.
- Faster ridges with more persistent liquid chambers will, on average, undergo more advanced fractional crystallization.