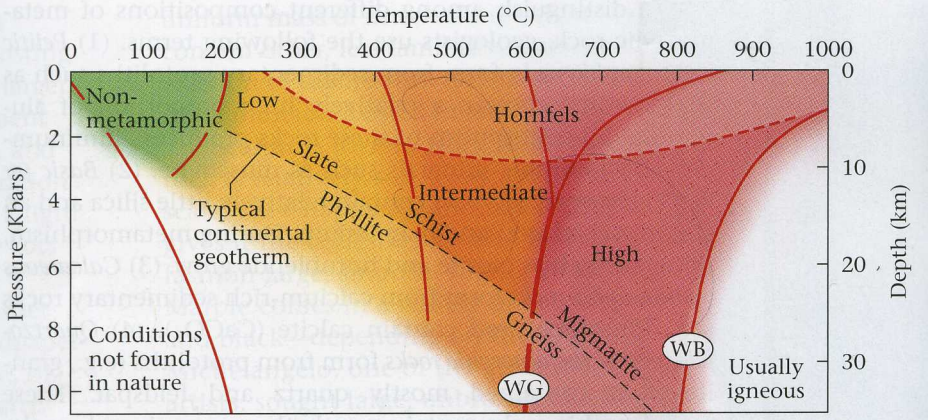

PROTOLITH	LOW	INTERMEDIATE	HIGH	PARTIAL MELTING
Basalt (mafic)	Greenschist	Amphibolite	Mafic granulite	
	Zeolite, Chlorite, Epidote, No Al	Amphibole, Al, Garnet, Pyroxene		
Shale (pelitic)	Slate, Phyllite, Schist	Gneiss		Migmatite
Clay	Chlorite	Quartz/Feldspar, Muscovite, Biorite, Garnet, Staurolite, Kyanite	Sillimanite	

FIGURE 8.17 The concept of metamorphic grade. (a) A graph showing the approximate conditions of various grades. At low temperatures, only diagenesis takes place. At progressively higher temperatures, a rock passes from low to intermediate to high grade. Hornfels forms under conditions of relatively low pressure, where heat is provided by an adjacent magma intrusion. Slate, phyllite, schist, and gneiss form at progressively increasing depth in the crust, under conditions where temperature and pressure increase together. WG = conditions under which wet rock of granitic composition begins to melt. If this happens, migmatite can form (region with red stipple). If the rock does not contain water, melting doesn't begin until even higher temperatures; at that point, high-grade metamorphic rocks form. WB = conditions under which wet basalt begins to melt. (b) The minerals that form in a given rock depend on grade *and* composition. This chart contrasts important metamorphic minerals that form, at different grades, from a basalt protolith with those formed from a shale protolith.

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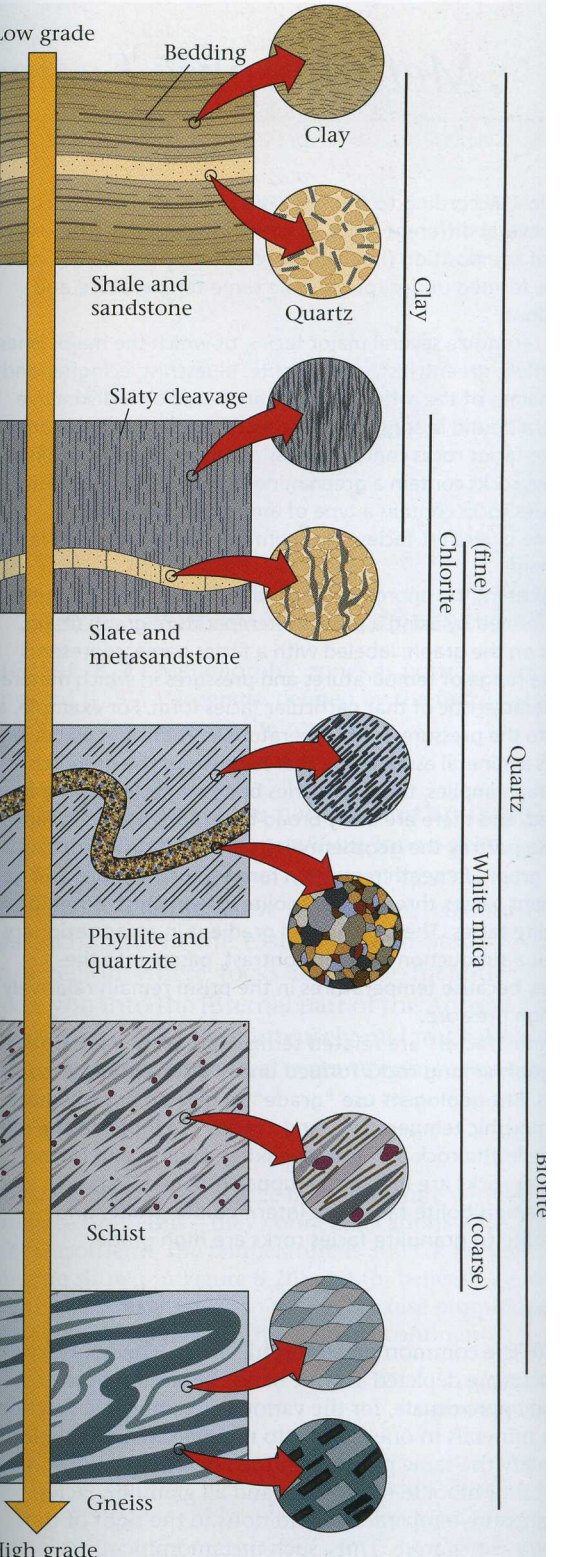

FIGURE 8.18 When shale progressively metamorph
low grade to high grade, it first becomes slate, then p
schist, then gneiss. In many cases, gneiss and schist c
under the same conditions. The side graph shows the
range of various minerals.