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These four photographs illustrate a vertical section through the metamorphic rocks beneath the Samail ophiolite (Figure 169.1), Oman, from the Green Pool section along Wadi Tayin (Ghent and Stout, 1981). These rocks are inferred to represent oceanic sedimentary and igneous rocks accreted to the base of the ophiolite during thrusting over a lower plate of oceanic lithosphere. An extreme inverted metamorphic gradient is present—in excess of $1000^{\circ}\text{C}/\text{km}$ —ranging from partially melted, upper amphibolite (locally granulite) facies immediately beneath the peridotite tectonite of the ophiolite's mantle section, down through lower amphibolite-facies rocks (Searle, 1980). Zircon ages from the crustal plutonic sequence fall chiefly in the range 95.4–94.5 Ma (Tilton and others, 1981), whereas $^{40}\text{Ar}/^{39}\text{Ar}$ ages indicate that the metamorphic rocks shown here cooled below $\sim 525^{\circ}\text{C}$ by 95.7–92.4 Ma.

The Samail ophiolite was probably thrust ≤ 300 km at a rate of 50–100 km/Ma over a period of 1–3 Ma (Hacker, 1990, 1991, 1994). Some of this displacement occurred within the overlying peridotite tectonite, and some was accommodated at lower temperatures in fault zones structurally beneath the section shown here. If 100 km of displacement was accommodated within the ~ 200 m thick metamorphic sole, the average shear strain and shear strain rate were on the order of ~ 500 and 10^{-12} s^{-1} , respectively.

All photographs were taken in plane polarized light of thin sections cut parallel to the lineation and perpendicular to the foliation. Labels: cpx: clinopyroxene; ep: epidote; grt: garnet; hbl: hornblende; plg: plagioclase.

169A. Metasomatic gneiss collected 1 m beneath the peridotite tectonite. Peak upper amphibolite-facies mineral assemblage is 60% ferroan pargasitic hornblende + 10% clinopyroxene ($\text{Wo}_{47}\text{En}_{36}\text{Fs}_{17}$) + 20% almandine ($\text{Alm}_{49}\text{Grs}_{23}\text{Pyp}_{22}\text{Sps}_{03}$) + 5% plagioclase + 5% ilmenite formed at ~ 500 – 800 MPa and $\sim 725^{\circ}\text{C}$. Pyroxene crystals contain deformation twins and undulatory extinction; hornblende crystals exhibit undulatory extinction and large subgrains bounded by $\{\text{hk}0\}$ walls. Garnet is undeformed and plagioclase deformation features are not visible because of alteration. Subsequent retrogression includes replacement of plagioclase by muscovite + albite, hornblende and clinopyroxene by epidote + pumpellyite + sphene, and ilmenite by hematite; none of the secondary phases are deformed. Sample Oman-153. PPL

169B. Metabasaltic amphibolite-facies gneiss collected 48 m beneath the peridotite tectonite. Peak mineral assemblage is 73% tschermakitic hornblende zoned to magnesio-hornblende + 10% epidote + 15% An_{54} plagioclase + 2% rutile. Hornblende porphyroclasts contain numerous inclusions, are oriented with their *c*-axes at an angle to the foliation, exhibit undulatory extinction, and are recrystallized at their margins to smaller, subequant hornblendes (arrow). The abundant,

aligned, smaller hornblendes contain few inclusions or deformation features. Retrogression includes alteration of plagioclase to albite + sphene + muscovite, replacement of hornblende by actinolite + chlorite + hematite, and crystallization of albite + pumpellyite + actinolite veins. None of the alteration phases are deformed. Sample Oman-25. PPL

169C. Metabasaltic amphibolite-facies schist collected 124 m beneath the peridotite tectonite. Peak mineral assemblage is 85% tschermakitic hornblende + 4% epidote + 10% An_{23} plagioclase + 1% rutile. Hornblende porphyroclasts are oriented with their *c*-axes at an angle to the foliation, exhibit undulatory extinction, and are recrystallized at their margins to form σ -type clasts with tails of much smaller, fibrous hornblendes (arrows). Plagioclase crystals also form σ -type clasts, and areas between brittlely extended epidote crystals are filled with chlorite. Subsequent retrogression includes replacement of plagioclase by albite + muscovite, and alteration of hornblende to actinolite + chlorite + sphene; none of these phases are deformed. Sample Oman-135. PPL

169D. Metabasaltic amphibolite-facies schist collected 202 m beneath the peridotite tectonite. Peak mineral assemblage is 45% tschermakitic hornblende zoned to magnesio-hornblende + 35% plagioclase + 15% epidote + 10% ilmenite. Plagioclase porphyroclasts dot an otherwise uninterrupted fabric of optically undeformed fine-grained hornblende crystals. Retrogressive phases include calcite + chlorite in veins, and albite, muscovite, chlorite, and hematite; none of these phases are deformed. Sample Oman-126. PPL

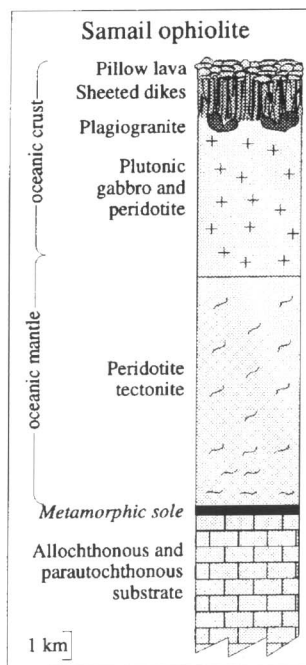
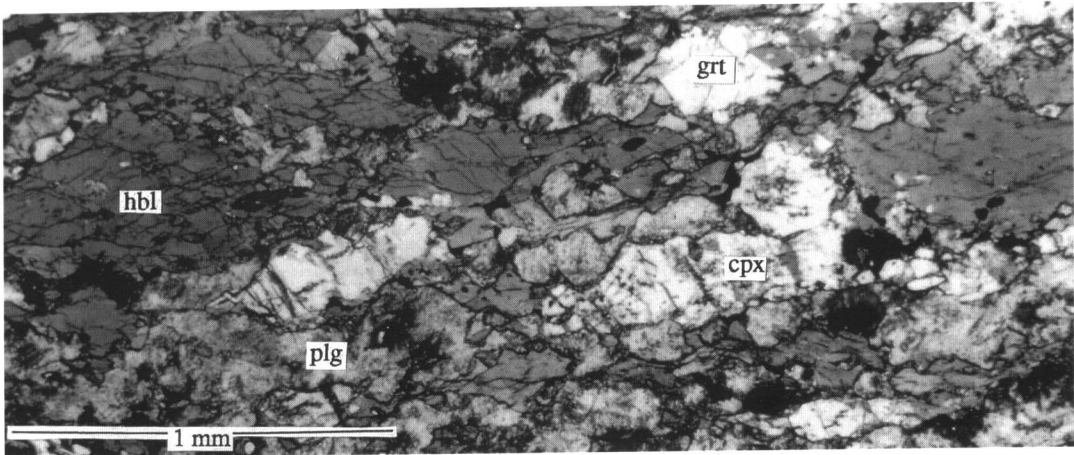
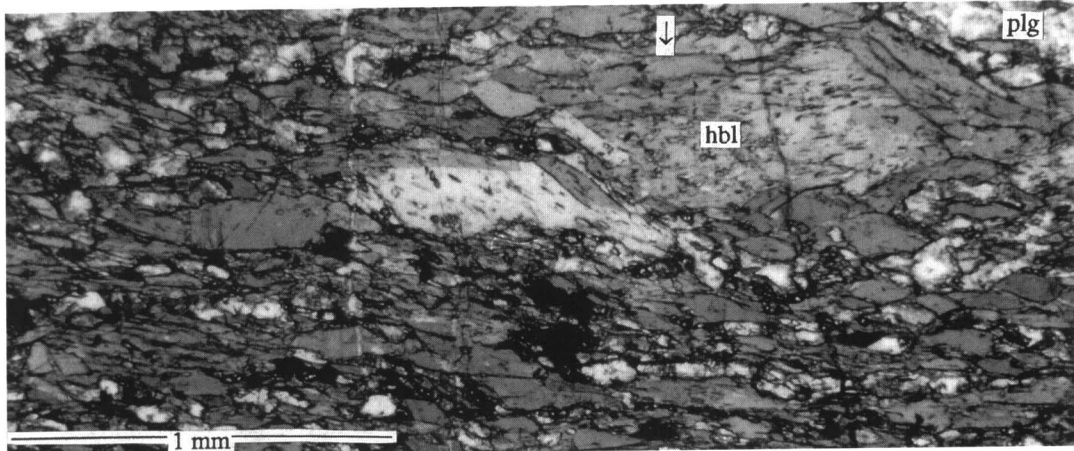


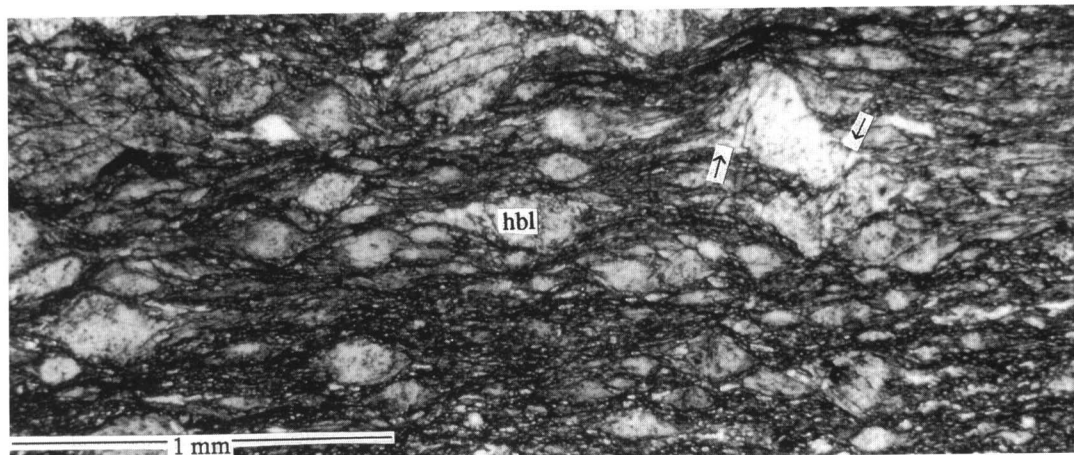
Figure 169.1. Schematic pseudostratigraphic column through the Samail ophiolite, Oman.



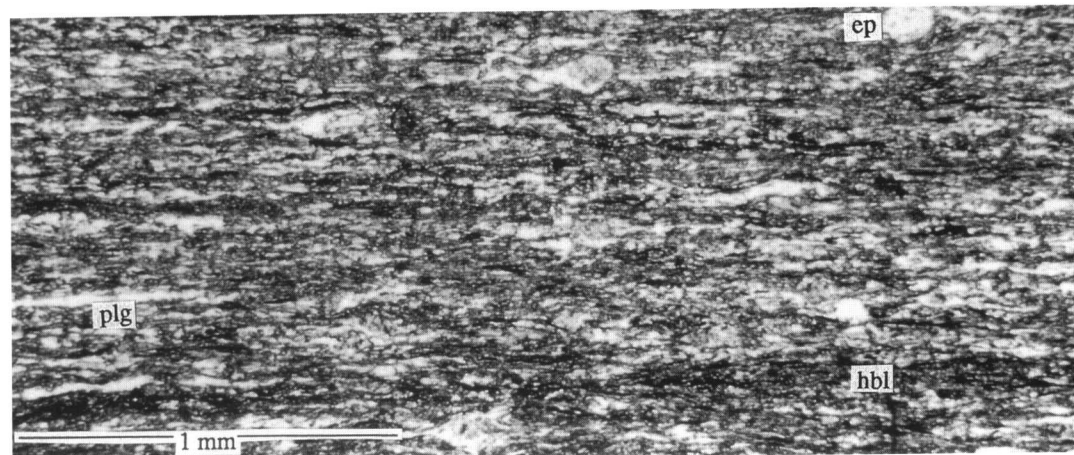
169 A



169 B



169 C



169 D