SUBDUCTION ZONE PETROTECTONIC ASSEMBLAGES

ACCRETIONARY WEDGE ROCKS: BLUESCHIST FACIES TEXTURES AND INDEX MINERALS

This suite of rocks includes samples from the Franciscan Assemblage in California and from the Cycladic subduction zone on the island of Syros, Greece. They are divided into three related suites (samples with accompanying thin sections are indicated with an asterisk):

FRANCISCAN ASSEMBLAGE:

1. Samples from the Eastern Belt, regional blueschist facies metagreywackes.
   Very low T, high P metamorphism with little textural reconstitution
   Samples: 86-9; 86-16Y*; 86-50*; 86-62b*
2. Samples from knockers within Eastern and Central belt melanges, blueschist and ecologite facies
   Moderate T, high P metamorphism with typical metamorphic fabrics
   Samples: 86-7; 86-8c; 86-10

SYROS:

3. Blueschist and (?) eclogite facies mafic and pelitic rocks.
   Moderate to high T, high P metamorphism with typical metamorphic fabrics
   Samples: SYR 99-31b; SYR 99-16*; SYR 99-78*

I. Study, observe and describe the fabric and texture of each of these three suites of rocks, *drawing whatever generalizations you think are sound.*

II. Identify each of the following key index minerals in hand specimens and thin sections. State one hand sample and thin section number in which each mineral can be found.

Key blueschist facies indicator minerals:

GLAUCOPHANE: $Na_2Mg_3Al_2[Si_8O_{22}](OH)_2$
a sodium amphibole; distinctively blue in hand sample. Pleochroic blue to purple to colorless in plane light. Prismatic, or anheadral with prismatic cleavage.

LAWSONITE: $CaAl_2(OH)_2[Si_2O_7]H_2O$
colorless in hand specimen and plane light. First order bright red to yellow interference colors. Higher relief than feldspar. Parallel extinction. Blades or prisms - in places with ragged ends.

JADEITE: $NaAl[Si_2O_6]$
a sodium pyroxene. Colorless in hand specimen and plane light. Anomalous bright blue to brown interference colors. High (pyroxene-like) relief. Shows a variety of habits: stubby; needle-like with pointed terminations; radiating mats of fine needles.

Minerals that commonly occur in blueschist facies rocks:

PUMPELLYITE: $Ca_4(Mg,Fe^{+2})(Al, Fe^{+3})5O(OH)_3[Si_2O_7)_2[SiO_4]2H_2O$

needles or mats of needles with anomalous blue to brown interference colors and relief higher than feldspar. Green-brown pleochroism distinguishes it from jadeite needles.

EPIDOTE: $CaFe^{+3}Al_2O\text{-}OH[Si_2O_7][SiO_4]$

light yellowish to grey in plane light; 2nd order interference colors. High relief. Prismatic with boxy to diamond end sections. Hard to distinguish from zoisite with microscope alone.

ZOISITE: $Ca_2Al\text{-}Al_2O\text{-}OH[Si_2O_7][SiO_4]$

grey in plane light; low 1st order interference colors and anomalous blue and yellow interference colors possible. High relief. Prismatic with boxy to diamond end sections.

OMPHACITE:

Na-pyroxene. Bright green in plane light and hand specimen. Light green to colorless pleochroism. High (pyroxene-like) relief. Stumpy to elongate prismatic habit. 1st order to low 2nd order interference colors.

ACCRETIONARY WEDGE ROCKS: MÉLANGE

This lab includes three samples from mélanges associated with Iapetus subduction in Newfoundland.

Sample A shows "web texture". This is commonly developed in disrupted sandstones in melanges. It probably results from catastrophic dewatering during intergranular deformation.

Samples B and C are samples of the mud matrix from a melange. Examine the fine-scale fabric in the mudstones and observe the disruption of layering.

ARC-RELATED ROCKS: THE CLASSIC ARC VOLCANIC PETROTECTONIC ASSEMBLAGE

Use the suite of "classic" arc rocks to review the arc petrotectonic assemblage. (These are samples # SH 7, SH 17, CHI, LP-34, EM 228P2, SN 37, and SN 43.)

I. Name each rock sample.

II. Indicate which you would expect to find in an immature oceanic island arc, a mature oceanic island arc, and a continental (Andean) arc (you may use one rock type in one or more of these categories).

The following major element geochemistry for three of these samples my be of assistance to you.

Sample	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO
SH-7	49.04	0.98	17.62	9.81	0	0.17
LP-34	66.22	0.44	15.71	4.02	0	0.08
SH-17	70.71	0.3	15.92	2.76	0	0.07

Sample		MgO	CaO	Na[2]O	K[2]O	P[2]O[5]
SH-7		9.03	10.63	2.75	0.27	0.1
LP-34		2.37	4.64	3.85	2.22	0.1
SH-17		0.4	2.19	4.93	2.64	0.08

ARC-RELATED ROCKS: PYROCLASTIC ROCKS

Because of the inherent volatile content of their magmas, arc systems (in contrast to, say, MOR's) are commonly and frequently explosive in character. The lithologic products of explosive volcanism are known as pyroclastic rocks. Pyroclastic rocks can be very difficult to study and are commonly avoided! (They can be difficult to distinguish in their field setting, in hand specimen, and even in thin section from epiclastic rocks, which are resedimented volcanic clastic rocks, or from aphanitic extrusive rocks.) Therefore, we are going to take this opportunity to start familiarizing ourselves with pyroclastic rocks.

You will be using the following samples for this (samples with asterisks have accompanying thin sections):

88-04c-SY	163c'
88-04c2-SY	95-DY-17*
88-SY-12b	95-DY-43*
88-SY-14a2	95-DY-56a*
Costa Rica sample	95-DY-97*

I. Name each of the pyroclastic rocks in this lab according to the following scheme:

Classification of Pyroclastic rocks by fragment size

Size in mm	Pyroclast (fragment) name	Pyroclastic rock name
> 64	Bomb (material hot enough when ejected to take on a streamlined shape)	Volcanic agglomerate
	Block (fragment solid when ejected, showing angular shape)	Pyroclastic breccia
2 - 64	Lapillus/lapilli	Lapilli tuff
< 2	Ash (ash can be lithic fragments, glass shards, or single euhedral crystals)	Ash tuff

II. Compare an aphanitic pyroclastic rock (an ash tuff) (Samples 95-DY-43; 95-DY-17; and 88 04c-SY) to an aphanitic extrusive rock (95-DY-56a and 95-DY-97). What characteristics might allow you to discriminate between the two in hand specimen? in the field?

III. Describe the lapilli in sample 88-04c2-SY, 88-SY-14a2 and in sample "Costa Rica". To what might you ascribe the difference in shape? The lapilli in sample 88-SY-14a2 are rounded. How would you determine if they are epiclastic or pyroclastic?