1-2002

GEOL 525.01: Igneous Petrology

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Geology 525 Igneous Petrology, Spring, 2002

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Tu, Th 1-4 Text: An Intro. To Igneous and Metamorphic Petrology, 2001, J.D. Winter

Tentative Date	*pages*	Topic (read text pages before coming to class)
1/29	*12-14*, 18-26	Pressure at depth, conversions of units, temperatures. Classifications.
	27-45, *46-74*	Textures. Structures.
1/31	*75-83*, *84-91*	Thermodynamics in Igneous processes. Entropy, Clapeyron equation. Phase rule.
2/5	*92-104*	Binary systems: solid solution, eutectic, peritectic, solvus.
2/7	*105-118*	Ternary systems:An-Di-Fo, An-Ab-Di, An-Ab-Or. Pressure-temperature liquidus-solidus for melting basalt.
2/12	*119-127*	Effect of pressure on melting and crystallization under dry conditions. Solubility of water in magmas and effect on crystallization temperature.
2/14	*128-140*	Analytical methods, representative analyses, Harker diagrams,
2/19	*140-143*	Pearce element ratios. Graphical models of magma evolution.
	147-148	Alkali-lime index, alumina-saturation index, Σ alkalis vs silica.
	148-152	Ne-Di-Fo-Q basalt tetrahedron; sodic and potassic series.
2/21	*155-157*	Transition metals (Sc, Ti, V, Cr, Mn, Co, Ni, Cu, Zn), REE, other trace elements. Distribution coefficients (K_D), incompatible & compatible elements, high field strength, large-ion lithophile elements.
	157-164	Batch melting, Raleigh fractionation, Eu anomalies, spider diagrams
2/26	*164-166*	Trace-element ratios and igneous process.
	166-167	Trace-element ratios and tectonic environment.
	181-185	Basalt mineralogy. Generation of basalt magma. Mantle petrology.
	185-199	Mantle melting influences. Basalts from different mantle compositions.
2/28	*200-210*	Melt separation and %. Magmatic differentiation, Stokes' Law. Q-Ab-Or diagram. Volatile transport, liquid immiscibility.
	210-217	Magma mingling and mixing, assimilation.
	218	Tectonic-igneous associations.
3/5	*219-221*	Layered mafic intrusions. Cryptic and rhythmic layering.
	221-232	Examples: Bushveld, Stillwater, Skaergaard, and internal layering.
	232-241	Differentiation processes, recharge and magma mixing, density currents.
3/7	*242-247*	Mid-ocean ridge basalt (MORB), ophiolite section and seismic velocity.
	247-251	MORB petrography and chemistry; variation, compositions and whether primary magmas. N-MORBS & E-MORBS.
3/12	*251.9-259*	MORB trace-element and isotope variation. REE in N- & E-MORBS and models for their formation and evolution.
3/14	*260-262*	Oceanic intraplate volcanism (OIBs), hot spots/plumes. Tholeiitic basalts with early and late alkaline varieties.
	263	Differences from MORBS. Norms of alkaline and tholeittic varieties.
	266	Differentiation trends. Trace-element geochemistry.

3/18-3/22 ========== Spring Break ==========

3/26	*269-270* *274-276*	Isotope geochemistry: Nd and Sr isotopes. Petrogenesis of Oceanic Island Basalts (OIB)
3/28	*269-270* *274-276*	Isotope geochemistry: Nd and Sr isotopes. Petrogenesis of Oceanic Island Basalts.
4/2	*277-279* *279-292*	Continental flood basalts: tectonic setting; all shortlived. Columbia R. basalt, evolved tholeiite chemistry, trends. Sr & Nd isotope trends enriched with time; mantle sources.
4/4	*293-301* *302-304*	Subduction: island arcs: chemical classifications. Major-element chem. Spatial and temporal variation in arcs.
4/9	*304-309* *309-315*	Island arc trace elements; isotopic variation. Petrogenesis of island-arc volcanic rocks.
4/11	*316-326* *326-329*	Subduction: continental arcs – chemistry and petrogenesis: the Andes. The Cascades.
4/16	*330-342*	Plutonic belts of volcanic arcs: shallow plutons, calderas, ash flows. Petrogenesis of continental arc magmas.
4/18	*343-351,* *352-358*	Granitoid rocks: petrography, geochemistry. Classification and tectonic settings of granitoid rocks.
4/23	*358-361*	Chemical discrimination; mantle contribution; origin of continental crust.
4/25	*362-374*	Continental alkaline rift magmatism: main rock types; East African Rift geochemistry and evolution.
4/30	*375-386*	Carbonatites: environment, chemistry; primary and evolved magmas. Liquid immiscibility.
5/2	*386-400*	High-potassium rocks; extreme geochemistry. Petrography and field relationships. Mantle xenoliths and metasomatism
5/7	*401-*	Anorthosites: petrology, geochemistry. Archean versus Proterozoic anorthosites. Lunar anorthosites.
5/9		**===Term papers – class presentation ===**

Term Paper/project: < 8 pages, excluding diagrams and reference list.
Review the Bearpaw Mountains unit of the Central Montana High-Potassium Province, emphasizing recent references.
Divide up the subject between you. Work cooperatively, overlapping information between your separate parts.
Use chemical data from Tureck-Schwartz and Hyndman.
Discussion of chemical and mineralogical controls begins in the text in Ch. 8.

1. Ultramafic to mafic rocks, their evolution and controls, and the "parent shonkinite magma."
2. Intermediate compositions, their evolution and controls.
3. Felsic compositions including latites, syenites, and related rocks; their evolution and controls.

Check with me as you proceed.

4/23: ***Term paper/project*** due in class.
5/13-17 *Final Exam Week*; 525 **Final** @1-3pm, Mon. May 13.

Final grade is based equally on term paper/project, work in class,
and final.

LAB THIN SECTIONS
Each thin section to be described in detail using the forms provided.
Results to be reviewed in lab.

Lab	**Number**	
1	141.85	Idaho batholith main phase, Lochsa Valley
2	Kam-1	Kamiah plutonic complex (western border zone, Idaho batholith)
3	Stillwater 1	Stillwater Complex basal zone, Montana
4	Stillwater 2	Stillwater Complex gabbro
5	DF 3a	Bay of Islands ophiolite
6	DF 2a	Bay of Islands ophiolite
7	DF 02a	Bay of Islands ophiolite
8	Haw-1	Hawaiian basalt, Kilauea
9	Purcell	Purcell diabase sill, Montana
10	2383	Oga Peninsula, arc volcanic rock, Japan
11	2388	Oga Peninsula, arc volcanic rock, Japan
12	BT	Bishop Tuff, California – welded near base
13	BT2/BP2	Bishop Tuff, California – less welded upper part.
14	Al-1	Shonkin Sag laccolith, Montana