Lecture 5 Plutonic Structures and Field Relationships

Friday, February 4th, 2005

Figure 4-20. Schematic block diagram of some intrusive bodies.

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Figure 4.21. Kangamiut dike swarm in the Søndre Strømfjord region of SE Greenland. From Escher et al. (1976), Geology of Greenland. © The Geological Survey of Denmark and Greenland. 77-95.

Figure 4-23. The formation of ring dikes and cone sheets. 

a. Cross section of a rising pluton causing fracture and stoping of roof blocks.

b. Cylindrical blocks drop into less dense magma below, resulting in ring dikes.

c. Hypothetical map view of a ring dike with N-S striking country rock strata as might result from erosion to a level approximating X-Y in (b). d. Upward pressure of a pluton lifts the roof as conical blocks in this cross section. Magma follows the fractures, producing cone sheets. Original horizontal bedding plane shows offsets in the conical blocks. (a), (b), and (d) after Billings (1972), *Structural Geology*, Prentice-Hall, Inc. (c) after Compton (1985), *Geology in the Field*, © Wiley, New York.

Figure 4-24. b. Cone sheets in the same area of Mull, after Ritchey (1961), British Regional Geology, Scotland, the Tertiary Volcanic Districts. Note that the yellow felsite ring dike in part (a) is shown as the red ring in the NW of part (b). British Geological Survey.

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Figure 4-25. Types of tabular igneous bodies in bedded strata based on method of emplacement. a. Simple dilation (arrows) associated with injection. b. No dilation associated with replacement or stoping. © John Winter and Prentice Hall.
Figure 4-26. Shapes of two concordant plutons. a. Laccolith with flat floor and arched roof. b. Lopolith intruded into a structural basin. The scale is not the same for these two plutons, a lopolith is generally much larger. © John Winter and Prentice Hall.

Figure 4-27. Gradational border zones between homogeneous igneous rock (light) and country rock (dark). After Compton (1962), Manual of Field Geology. © R. Compton.
Figure 4-28. Marginal foliations developed within a pluton as a result of differential motion across the contact. From Lahee (1961), Field Geology. © McGraw Hill. New York.

Figure 4-29. Continuity of foliation across an igneous contact for a pre- or syn-tectonic pluton. From Compton (1962), Manual of Field Geology. © R. Compton.
Figure 4-30. Block diagram several kilometers across, illustrating some relationships with the country rock near the top of a barely exposed pluton in the epizone. The original upper contact above the surface is approximated by the dashed line on the front plane. From Lahee (1961), *Field Geology*. © McGraw Hill. New York.

Figure 4-31. a. General characteristics of plutons in the epizone, mesozone, and catazone. From Buddington (1959), *Geol. Soc. Amer. Bull.*, 70, 671-747.

Figure 4-33. Block diagram of subsurface salt diapirs in Northern Germany. After Trusheim (1960), Bull. Amer. Assoc. Petrol. Geol., 44, 1519-1540 © AAPG.
Figure 4-34. Diagrammatic illustration of proposed pluton emplacement mechanisms. 1- doming of roof; 2- wall rock assimilation, partial melting, zone melting; 3- stoping; 4- ductile wall rock deformation and wall rock return flow; 5- lateral wall rock displacement by faulting or folding; 6- (and 1)- emplacement into extensional environment. After Paterson et al. (1991), Contact Metamorphism. Rev. in Mineralogy, 26, pp. 105-206. © Min. Soc. Amer.

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**Figure 4-36.** Diagrammatic cross section of the Boulder Batholith, Montana, prior to exposure. After Hamilton and Myers (1967), The nature of batholiths. USGS Prof. Paper, 554-C, c1-c30.

**Figure 4-37.** Schematic section through a hydrothermal system developed above a magma chamber in a silicic volcanic terrane. After Henley and Ellis (1983), *Earth Sci. Rev.*, 19, 1-50. Oxygen isotopic studies have shown that most of the water flow (dark arrows) is recirculated meteoric water. Juvenile magmatic water is typically of minor importance. Elsevier Science.