G528 - Sandstone Provenance Lab, 2011
Due Monday, March 7, 2011 at beginning of class

This lab is designed to introduce you to the basics of sandstone composition in both hand specimen and thin-sections and the means by which it can be used to infer the composition of eroded source terrains (i.e., provenance analysis). Please examine the following specimens and answer *each* of the questions posed. When answering the following questions, be sure to cite your evidence. Each sample is worth 7 points. Sketches are always a good idea, but aren't required. This lab will probably take 7-12 hours, depending on how much experience you have examining sandstones in thin-section.

I. 94-Challis: Eocene Challis Volcanics – central Idaho: This "sandstone" is composed almost exclusively of a single grain type. What is the mineralogy of the grains that make up this rock? Cite your evidence. In a few words, describe the texture of the grains.

II. 95-NAV: Jurassic Navajo Sandstone, San Rafael Swell, central Utah: Describe this rock in a few sentences. What is its mineralogic and textural maturity? Estimate the relative percentages of Q-F-L for this sample and suggest a likely tectonic setting.

III. 87-WICAMB-3: Cambrian Jordan Sandstone near Madison, Wisconsin: Note the yellow K-feldspar stain on half of this rock. What are the main minerals you see in thin-section? In particular, what are the green grains? Can you assign any environmental significance to them (i.e., what do they usually signify?) Discuss in a sentence or two what you infer to be the likely tectonic setting.

IV. 90-DOMEN: Eocene Domengine Sandstone, Vallacitos Syncline, California Coast Ranges, central California: Describe the mineralogic and textural maturity of this sandstone and compare it to 95-NAV. (A sketch of each might be worthwhile.) Sample 90-DOMEN was deposited in a very humid climate. Do you see any signs of accelerated chemical weathering in this sample and, if so, what? Note – thin-section of this sample is in two pieces.

V. 90-MONO-2: Quaternary sandstone, Mono Lake, California: Describe the mineralology and texture of this rock. Estimate the relative percentages of Q-F-L and QpLvLsm and discuss its likely tectonic setting.

VI.95-MALAW 1: Modern beach sand, Lake Malawi, Kenya, Africa: Describe the composition of this sand. What are all the pleochroic minerals with high birefringence? This sediment was collected from a beach. Might the environment of deposition have had some influence on the composition of this sand? How?

VII. 93-SITES 1: Lower Cretaceous Sites Sandstone, Cache Creek, California Coast Ranges: Note that this sample is stained yellow for K-spar. Describe the mineralogy of this rock and estimate its relative percentages of Q-F-L and Qp-Lv-Lsm. What sort of tectonic petrofacies would you infer for this sample and why?

VIII. 95-Vanhn 2: Cambrian Vaughn Sandstone, West Texas: Describe the mineralology and texture of this sample. Do you think this a first-cycle sandstone? Estimate its relative percentages of Q-F-L and infer its tectonic setting.

IX. 94-FRAN-1: Jurassic Franciscan Formation, Marin Headlands, Marin County, California: This is not a sandstone, but it is a sedimentary rock. What sort of sedimentary rock is it? (i.e. what would you call it?) What are the small, sub millimeter round features? What sort of depositional environment would you infer for this sample.

X. 95-Jm-1: Jurassic Morrison Formation, northern Uinta Basin, Utah: Hand-specimen only – no thin-section. Describe the mineralogy and texture of this rock. What is the principal cement type? Estimate the relative percentages of Q-F-L and infer the likely tectonic setting for this sample ala Dickinson.

XI. RAP-III-79.1a: Eocene Renova Formation, Flint Creek basin near Drummond, Montana: List the main clast types you can identify in this sandstone. What sort of source terrane was eroded to produce this sandstone? Using the relationships between sand composition and tectonic setting described by Dickinson and others, what tectonic provenance field does this sample most likely represent?

XII. 95-Powow: Powow conglomerate, Permian, West Texas: List the clast types you can identify in this sample. Which of the three main plate tectonic settings for sandstone compositions in Dickinson (1979; (recycled orogen, magmatic arc provenance, stable craton) does this sandstone most easily fit?

XIII. 94-Orinda: Eocene Orinda Sandstone near Caldecott Tunnel, Hayward, California: List all the clast types you can identify in this sandstone. Is this sandstone mineralogically mature or immature? Assuming that all grains in this sandstone were derived from a single source area, what sort of tectonic setting might you infer for that source terrane and why?

XIV. 97-NU-408: Triassic sandstone from Noyon Uul (King Mountain), southern Mongolia. This is a complicated sandstone. Take a few minutes to examine it and identify as many grain types as you can. Note that much of this sample is stained yellow for potassium (K-spars are yellow) and red for carbonates (calcite is red). What sort of provenance was the likely source terrane for this sandstone in the nomenclature of Dickinson and Suczek, 1979? Note thin-section of this sample is broken.