Application for a 2009 GSA Research Grant
http://geosociety.org/grants/gradgrants.htm

Name: Chris Kohel

Project Title: Basin analysis and tectonic implications of cryptic deep water siliciclastics of the Mesozoic Eugenia Formation, Baja California Mexico

Project Supervisor: Kimbrough

Academic Info (Department Address): Department of Geological Sciences, San Diego State Univeristy.

Clearly state the problem(s) to be addressed, the hypothesis or hypotheses to be tested, and the overall objectives of your proposed project. **(1,200 character limit):**

This proposal seeks funds for a basin analysis study of deep water coarse-grained clastic and volcanic rocks of the Late Jurassic-Early Cretaceous Eugenia Formation in the Vizcaino Peninsula of Baja California Sur. These rocks represent a dramatic but poorly understood shift in Mesozoic sedimentation of the region. The Eugenia Formation was initially correlated to basal forearc basin strata of the Great Valley Group in California (Jones et al., 1976), however the presence of major sedimentary mélange-olistostrome intervals with megablocks of Triassic chert and quartzite, as well as interstratified alkalic pillow lava and the overall coarse-grained nature of the deposit represent major differences. The focus here will be to document the geometry, distribution, grain size and composition of conglomerates that make up a substantial portion of the formation. This work will help to clarify the depositional setting, regional correlation, and tectonic significance of the basin.

Discuss the previous work on your problem(s) that (1) places the project in a disciplinary and, if appropriate, regional context and (2) documents the importance of your project. (2,500 character limit):

The Vizcaino Peninsula contains a thick Late Triassic to Late Cretaceous sediment package floored by ophiolite and arc basement representing by far the best preserved record of forearc sedimentation and tectonics along a >2000 km length of the SW Cordillera (Busby et al., 1998; Kimbrough and Moore, 2003). The Tithonian-Valangenian Eugenia Formation (Mina, 1957) represents the most enigmatic part of Vizcaino forearc stratigraphy. The lack of any detailed mapping in the ~200 km^2 Eugenia Block is an important contributing factor to the lack of knowledge. Hickey (1984) conducted the most detailed study of the Eugenia Formation to date and interpreted it as the proximal deposits of an active volcanic arc. The active arc feeding the Eugenia basin in his model is represented on the Vizcaino Peninsula by the Sierra

San Andres complex. His conclusions were “based on a number of incomplete sections all across the Punta Eugenia fault block”, which is dissected by faults. Hickey’s interpretation fail to explain however the presence of alkaline pillow lava interbedded in the Eugenia Formation that indicate syndepositional rifting of the basin (Rangin et al., 1983). Further, more recent work in the Eugenia Fm has revealed the ubiquitous presence continentally derived quartzite clasts in conglomerate beds that were undocumented by all previous workers (Kimbrough et al., 2005). The quartzite clasts in the Eugenia range up to boulder size, but have no obvious source on the Vizcaino Peninsula. Reconnaissance hand specimen investigation suggests the Eugenia quartzite clasts resemble quartzite clasts from conglomerates in overlying Late Cretaceous Valle Group strata (Kimbrough et al., 2006)

Dickinson and Lawton (2001) interpret the Vizcaino rocks as part of the Guerrero terrane which they propose was accreted to the North American margin in the Early Cretaceous by closure of an intervening ocean basin. This model fails however fails to explain continental derived quartzite clasts Coloradito and Eugenia Formation strata as old as late Middle Jurassic on Cedros Island (Boles and Landis, 1984).

Work proposed here will contribute substantially to understanding the Eugenia Formation depositionally system by mapping out widespread conglomerate intervals through the Eugenia Block and studying the provenance of these rocks in detail.

Concisely state how you plan to address your problem(s) and test your hypothesis or hypotheses (2,500 character limit):

Field Work:

Mapping will be conducted in the northern Vizcaino Peninsula at the 1:10,000 scale covering an area of ~200 km^2. High resolution color satellite imagery from Google maps will be used as a base map. Reconnaissance field survey of the area, and study of satellite photos, demonstrates the widespread presence of coarse cobble-boulder conglomerate. The initial focus will be on mapping the distribution, strike and dip, and grain size, of the Eugenia Formation conglomerates. At each major conglomerate horizon the diameter of ten of the maximum-sized clasts will be measured and recorded in order to construct a regional conglomerate “grain size map”. Following this effort ~10 localities will be selected to conduct detailed clast counts. Clast counting at each locality will involve two steps: (1) clast counting of ~100 contiguous clasts in a randomly selected area; the size and degree of rounding of each individual clast will be recorded as counting proceeds, (2) a boulder clast count where >25 contiguous boulder-sized clasts will be counted. Special attention will be paid to all types of quartzite clasts recognized by hand specimen examination and will be collected for petrographic analysis.

Reconnaissance investigation reveals that granitoid clasts are also locally present at abundances of <5%. A representative suite of plutonic clasts will be selected for petrologic study and zircon U-Pb analysis. A representative suite of volcanic clasts will also be collected for petrographic study and zircon U-Pb analysis.

Lab work:

Thin section analysis of igneous clasts will help characterize these clasts in a petrographic sense and U/Pb zircon analysis of these clasts will define the age of formation of the protolith to these clasts. Thin section work on quartzite clasts found in different fault bounded blocks will allow for the differentiation of different types of quartzite clasts present in the Eugenia and will aid in correlating these fault separated blocks. They will also aid in matching the quartzite to potential continental sources. Geochemical analysis of igneous and volcanic conglomeritic clasts will provide insight into the bulk geochemical composition of the source.

Duration of investigation (dates):

Budget: LIST IN ORDER OF PRIORITY AND JUSTIFY IN DETAIL, for example, funding of chemical and isotopic analysis, equipment, technicians and expendable laboratory supplies is necessary for consideration. Grants are made for one year only.

- Gas Expenses $.32/milex1600miles = $512
- Insurance for travel in Mexico $350 for a 30day visit x 1 visit = $350
- Food expenses $15 a dayx30 daysx2 people= $900
- Thin Section Analysis $12x25= $300
- Total = $1962

Budget justification (1,200 character limit):

The requested funds are for the most basic necessities needed to conduct research. First and foremost you have to be able to get to your research area and get there safely. Gas prices haunt any research budget especially if the project area necessitates long ground transport. Further, traveling in Mexico requires specific car insurance recommended by the Mexican Government and required by our University as an affiliate of the project. The other large budget hurdle would be food costs which over a 30 day period could easily reach $450 estimating an average of $15 per day per person. This budget estimate accounts for a single persons food expenses in addition to a field assistant. Field research in remote desert environments is safer and more effective with a field assistant. Counting, sampling, and extraction of remote conglomerate suites are greatly expedited by field assistance, and will therefore greatly reduce the necessity of a second costly trip. Finally, the detailed conglomerate clast analysis would require numerous thin sections and it is my belief that ~25 thin sections would represent a minimum to produce a solid correlation between isolated conglomerate packages.

Amount and nature of other available funds, facilities, materials, etc. (1,200 character limit):

Sample preparation equipment required to produce billets for thin sections, rock powder for geochemical analysis, and zircon separation and mounting facilities for U/Pb zircon U-Pb later ablation ICPM analysis will be carried out at SDSU. Analytical equipment include an X-ray florescence (XRF) mass spectrometer used in geochemical analysis for major and trace element data as well as the equipment necessary to make the pellets and beads used in XRF analysis. Much of the material needed for mapping such as base maps, field equipment, and office supplies will be provided by the university. In addition the project has available the full technical support of the SDSU Geology Department faculty. Zircon U-Pb analyses will be carried out at the University of Arizona. There are currently no other funds available to help facilitate this project.

Abbreviated resume. List education, major positions held, and significant accomplishments. Provide information relevant to your qualifications to undertake proposed research. List up to 5 of your publications and presentations (2,500 character limit):

Education

University of Wisconsin - Eau Claire Eau Claire, Wisconsin
Bachelor of Science, 2006 May 2006
Major: Comprehensive Geology (Mathematics & Chemistry Emphasis)

Currently enrolled in Graduate Classes at San Diego Stae University

Honors, Awards

- Department of Geology Excellence Award, 2006
- Second place (natural and physical sciences category), U.W. Eau Claire Research Day 2006

Research and Work Experience

Geoscience BC Initiative (Rocks to Riches)
Field Assistant /Independent Mapper

- Assistant Mapper; Mapping deformed and metamorphosed volcanic stratigraphy, and igneous bodies within the core complex of the Coast Mountains, British Columbia, 2006.
- Field Assistant; mapping Jurassic age Hazelton volcanic stratigraphy in the Whitesail map sheet, British Columbia, 2004.
- Laboratory Assistant; Geochemical Analysis of Jurassic age Hazelton volcanic stratigraphy from the Coast Mountains of British Columbia, 2003-2004.

USGS EDMAP Project /Montana Bureau of Mines and Geology

- Assistant Mapper, Mapping PreCambrian and Paleozoic stratigraphy in the Tacoma Park, Devil's Fence, Willow Springs, and Dunn Creek 7.5 minute Quadrangles of Western Montana, 2004-2006.

- Primary Mapper, Geochemical analysis of satellite intrusive rocks related to the Boulder Batholith, within the Devil's Fence anticlinorium Boulder, Montana 2004-2006.

University of Wisconsin – Eau Claire Department of Geology Teaching Assistantships

- Geology 110 (2004-2006)
- Sedimentology and Stratigraphy (2005).

San Diego State University Department of Geology Teaching Assistantships

- Geology 221Minerology (fall 2008)
- Geology 508 Advanced Field Geology (spring 2009)

Recent Employment History

- One year and two months of employment with Texas Geologic Services as an on sight Geologist (2007, summer 2008).

Publications

Kjos, A.R., Maclaurin, C.I., Kohel, C.A., Nawikas, J.M., Stoltz, J.M., Mahoney, J.B., and Ihinger, P.D., 2006,
Reassessment of the Belt Supergroup: a stratigraphic analysis fo the Devil's Fence Anticlinorium, Southwest Montana [an EDMAP project]; Geological Society of America Abstracts with Programs, vol. 37, no. 7, p. 500.

Nawikas, J.M., Kohel, C.A., Stoltz, J.M., MacLaurin, C.I., Kjos, A.R., Mahoney, J.B., Ihinger, P.D., 2005, Structural and Magmatic Evolution of the Helena Salient: New Geologic Mapping in the Devils Fence Anticlinorium, Geological Society of America Abstracts with Programs, Vol. 37, No. 7, p. 76.

Kohel,C.A., Ihinger, P.D., Mahoney, J.B., 2006, Structural and Magmatic Evolution of the Helena salient, New Mapping and Spatial Geochemical Analysis in the Devil's Fence Anticlinorium. 14th Annual UW-Eau Claire Student Research Day—Poster Session.

Kohel, C.A., Nawikas, J.M., Macluarin, C.I., Kjos,, A. R., Stoltz, J.M., Mahoney, J.B., Ihinger, P.D., 2006, Structural-Magmatic Evolution of the Helena Salient. 7th Annual UW-System Symposium for Undergraduate Research and Creative Activity—Poster Session, Menomonie, WI.

References cited in proposal (2,500 character limit):

Boles, J.R., and Landis, C.A., 1984, Jurassic sedimentary melange and associated facies, Baja California, Mexico: Geologic Society of America Bulletin, v. 95, p. 513-521.

Busby, C.J., Smith, D., Morris, W., and Fackler-Adams, B.N., 1998, Evolutionary model for convergent margins facing large ocean basins; Mesozoic Baja California, Mexico: Geology, v. 26, p. 227-

DeGraaff-Surpless, K., 2002, zircon provenance analysis of the Great Valley Group, California: Evolution of an arc-forearc system, GSA Bulletin; December 2002; v. 114; no. 12; p. 1564–1580.

Dickinson, W.R., and Lawton, T.F., 2001, Carboniferous to Cretaceous assembly and fragmentation of Mexico: Geological Society of America Bulletin, v. 113, p. 1142.1160.

Hickey, J., 1984, Stratigraphy and composition of a Jura-Cretaceous volcanic arc apron, Punta Eugenia, Baja California Sur, Mexico, in Frizzell, V.A., Jr., ed., Geology of the Baja California peninsula: Field Trip Guidebook. Pacific Section, Society of Economic Paleontologists and Mineralogists Pacific Section, v. 39, p. 149.160.

Jones, D.L., Blake, M.C., Jr., and Rangin, C., 1976, The four Jurassic belts of northern California and their significance to the geology of the southern California borderland, *in* Howell, D.G., ed., Aspects of the geologic history of the California continental borderland, American Association of Petroleum Geologists, Pacific Section Miscellaneous Publication 24, p. 343-362.

Kimbrough, D.L., Hickey, J.J. and Tosdal, R.M., 1987, U-Pb ages of granitoid clasts in the upper Mesozoic arc-derived strata of the Vizcaino Peninsula, Baja California, Mexico: Geology, v.15, p.26-29

Kimbrough, D.L., and Moore, T.E., 2003, Ophiolite and volcanic arc assemblages on the Vizcaino Peninsula and Cedros Island, Baja California Sur, Mexico: Mesozoic forearc lithosphere of the Cordilleran magmatic arc, *in* Geological Society of America Special Paper 374. p. 43-72.

Kimbrough, D.L., Moore, T. E., Grove, M., Centeno-Garcia, E., Weber, B. and Gehrels, G., 2005, Tectonics of late Jurassic-early Cretaceous extensional basin development in the Vizcaino-Cedros region, Baja California and provenance linkage to the Guerrero terrane of mainland Mexico: Geological Society of America Abstracts w/ Programs, v. 37, No. 7, p. 19.

Kimbrough, D.L., Abbott, P.L., Grove, M., Smith, D.P., Mahoney, J.B., Moore, T.E., Gehrels, G.E., 2006, Contrasting cratonal provenances for upper Cretaceous Valle Group quartzite clasts, Baja California, in, Girty, G.H., and Cooper, J.D., eds, Using stratigraphy, sedimentology, and geochemistry to unravel the geologic history of the southwestern Cordillera, Pacific Section SEPM book #101, p. 97-110.

Mina, U. F., 1957, Bosquejo geologico del Territorio Sur de la Baja California: Association Mexicana de Geologos Petroleros Boletin, v. 9, p. 129-169.

Robinson, J.W., 1975, Reconnaissance geology of the Vizcaino Peninsula, Baja California Sur, Mexico [M.S. thesis]: San Diego State University, 114p.