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June 13, 1991

Dr. Norman Goldstein
Division of Engineering & Geosciences, ER-15
U.S. Department of Energy
19901 Germantown Road
Germantown, MD 20874

Dear Norm:

This letter represents a progress report on DOE FG03-90ER14154, entitled "Fluid Flow, Element Migration, and Petrotectonic Evolution of the Early Mesozoic Central Klamath Island Arc, Northwesternmost California." The first year of the award was funded at \$99,776 for the period 09/15/90 - 09/14/91. We now request support for the second (and last) year of the grant, 09/15/91 - 09/14/92, to be funded at a level of \$101,326. The research builds on an earlier grant, DOE FG03-87ER13806 (09/10/87 - 03/09/90, \$132,590).

Continuing investigations in the central Klamath Mountains by our group have documented the presence of a polymetamorphosed suite of highly magnesian basaltic rocks, the so-called Yellow Dog greenstones, in the Sawyers Bar terrane (=North Fork ophiolite) of the western Triassic and Paleozoic belt. The Yellow Dog metavolcanics display apparent komatiitic chemical affinities; if correctly interpreted, such an occurrence could have important significance for the thermal and petrotectonic evolution of the early Mesozoic Klamath island arc. The metabasalts were initially thought to reflect the Permo-Triassic to Middle Jurassic overriding of an oceanic hot spot by the stable, nonsubducted arc-capped North American lithospheric plate, but are now regarded as metamorphosed, mildly alkalic oceanic island lavas (OIBs) and surmounting immature calc-alkaline arc basalts (IATs). These igneous rocks are interlayered with, and are interpreted to largely overlie distal turbidites. The assemblage was laid down, altered and metasomatized during the hypothesized collapse of a Philippine Sea-type marginal basin which brought the westerly Sawyers Bar oceanic arc terrane into juxtaposition with the inboard, pre-existing Stuart Fork subduction complex, in an immature island-arc setting.

Supported research has concentrated on elucidating the areal extent and structural/stratigraphic relations of these mafic/ultramafic Yellow Dog metavolcanic units, and has documented the insignificant degree of crustal contamination of the melts by associated terrigenous metasediments. The physical conditions of metamorphism and of water-rock interaction accompanying island-arc accretion have been determined as follows: Middle Jurassic regional metamorphism of the Sawyers Bar/Stuart Fork amalgamated terrane took place at 350-500°C and 2.5-4.5kb; contact aureoles peripheral to the mid-Jurassic calc-alkaline plutons reached maximum physical conditions of 500-600°C at 2.0-3.5 kb. Intrusion of the post-collisional granitoids mobilized alkalis, silicas, rare earths, and, especially, oxygen isotopes in the sedimentary strata intimately interlayered with the Yellow Dog greenstones, overprinting the effects of an inferred earlier seafloor alteration in the mafic volcanics. The thermal structure and its evolution in the central Klamath Mountains evidently reflects surfaceward advective transport of magmatic energy derived from the partly fused downgoing oceanic slab, as well as hydrothermal fluid circulation.

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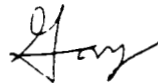
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Clarification of the element migration, volatile pathways, and thermal evolution of this crust-constructural event in the immature island arc are the goals of the DOE-funded research now underway, employing both field and geochemical methods.

One postdoctoral fellow (Brad Hacker) and two Ph.D. candidates (Dave Miller and Steve Forest) are partially or fully supported by the DOE Grant (no salary support is utilized for the P.I.). We have nearly finished a regional reconnaissance map showing the distribution of the OIB lavas throughout the California part of the Klamath Mountains. Investigation of the regional and contact metamorphism/metasomatism of the Sawyers Bar area is in progress. A manuscript demonstrating the presence of at least two ages of diabase dike/sill emplacement is nearly ready for submission to a journal. And, a 1:24,000-scale, colored map of the Sawyers Bar area is approaching completion.

No papers have yet been published, but as can be seen from our final report on the earlier DOE Grant, (letter to Bill Luth of 3/28/91) abundant productivity is on the way!

Best regards,



W.G. Ernst
Dean

cc: Dr. W.C. Luth

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